Perils of Progress Talk:
Some Historical Considerations

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Introduction

By most measures, 1933 was the worst year in America's long economic history. Unemployment, in the fifth year of a Savage depression, reached its highest level, 25.2 percent. 1 Bread lines and homeless wanderers provided the body politic with vivid images of shattering failure in the body economic. Still, visitors to Chicago's International Exposition that year saw no sign of social pain. The dazzling spectacle (boasting "more colored lights . . . than in any equal area or even any city of the world") was dedicated to a "Century of Progress." In the official Guidebook's effusive prose:

The dawn of an unprecedented era of discovery, invention, and development of things to effect the comfort, convenience, and welfare of mankind ... An epic theme! You grasp its stupendous stature only when you stop to contemplate the wonders which this century has wrought.2

A more blatant example of Depression incongruities would be hard to imagine: overwhelming human suffering juxtaposed with unabashed huckstering. It is tempting to explain the Exposition's upbeat theme as simply another example of the popular escapism manifest in the spate of entertainment movies so popular during the era. Images of prosperity provide some slim comfort in grim times. Such an explanation ultimately falls short, however, because it overlooks ominous undertones found in the fair's iconography and guidebook rhetoric. Three examples suffice. "Science" and "Industry," the second term a conflation of technology and business, were represented by two forty-foot, aluminum coated figures frowning down upon entrants to the Hall of Administration. Even more striking, visitors to the Hall of Science were met in the foyer by the "Fountain of Science" with Louise Lentz Woodruff's three-piece sculpture, "Science Advancing Mankind." Two life-size figures, male and female, faced forward with arms uplifted. Both were dwarfed by the massive figure of a robot twice their size. In the words of Lenox Lohr, general manager of the exposition, the robot
typified "the exactitude, force and onward movement of science, with its hands at the backs of the figures of a man and a woman, urging them on to the fuller life." Finally, the sculpture's iconographic message was aptly reinforced by the Guidebook's stunning, bold-faced thematic motto: "SCIENCE FINDS, INDUSTRY APPLIES, MAN CONFORMS."

The Exposition, in short, celebrated inevitable scientific-technological progress while reducing the human role in the process to conformity. How can we explain the paradox inherent in such visual and rhetorical imagery? How have Science, Technology, and Business, the three prime agents in the West's claim of human triumph over life's ancient constraints, come to be linked with passive conformism? In what follows, I will argue that the connection is much more than an oddity unique to Chicago and 1933. Rather, it lies at the core of one form of progress ideology that I shall call "autonomous progressive determinism." My purpose here is to explore some of its origins and to critique its role in our contemporary discourse. Put briefly, the ideological position I am concerned with argues the following six points: that since the 17th-century "Scientific Revolution," humanity has had access to a radically new form of knowledge, sometimes called the scientific method, sometimes called the controlled-variable experimental method; that the scientific method yields value-free truth, which liberates humanity from the bias and superstition of prior forms of knowledge; that the 18th-century "Industrial Revolution" created a radically new form of technology whose methodological power depends on its primary characteristic, namely, the application of science; that the two methods demand freedom from the influence of all outside controls; that the emergence of capitalism during the same Industrial Revolution marks the beginning of an economic method (the invisible hand of the free market) similarly free from the exterior constraints of tradition and bias; and that these three new forces, taken together, operate as an inevitable, autonomous force called "Progress," which continually advances humanity's conquest of nature.

It has become abundantly clear that I am not enamored of this rhetoric of progressive determinism. Before turning to my specific critiques of the position, however, a disclaimer is in order. I do not mean to argue here that science, technology, or business, terms used for a wide variety of human endeavors, are simply evil or good. Nor do I want to suggest that various scientific and technological traditions have not been cumulative, that earlier science or technology has not influenced what has followed. My position is, rather, that the ideology of progress as an inevitable deterministic process has operated as a quasi-religious belief in the West and that, to some extent, all citizens of the West carry fragments of it embedded in our language and attitudes. Few, if any, still defend this pure position. Why then take the trouble of detailed discussion?

Progress talk remains influential today as a language that normally operates on the semiconscious level of uncritical assumptions. It fosters
some modes of discourse while rendering others less accessible and impoverishing our imaginations in the process. Inherited language influences us all; we remain citizens of our traditional culture. Paying attention to the pure position alerts us to our various ways of buying into the ideology both in our linguistic habits and our affective responses to scientific, technological, and business issues.  

I will begin by trying to sort out several conceptual strands that frequently appear in discussions of progress ideology, paying particular attention to the United State's context and to several remarkable shifts in the popularly accepted meaning of progress between the Revolution and the present. I will then discuss its roots in European philosophical discourse and analyze what I take to be its pivotal assumption, the claim that scientific, technological, and business methods must operate independently of their contexts. After criticizing the rhetoric of autonomous progress on historical and logical grounds, I will suggest two destructive consequences of this linguistic heritage; the legitimation of Western colonial violence and the inculcation of political passivity among citizens of the West. Finally, and briefly, I will refer to my own alternative model for a language that interprets technological change without Succumbing to the seduction of progress talk.

Progress Talk in United States Discourse

"Progress," as an explanatory model for history, has proved a slippery concept. Several thoughtful essays about its place in the United States context provide a helpful starting point. Leo Marx and Merritt Roe Smith have called attention to a significant shift in the concept of progress that had dramatically affected its role in shaping the nation's self-understanding.

Marx begins by describing the earlier "Enlightenment" approach:

The concept of history that won favor at the time [18th century] turns on the idea of "progress": the belief that history is the record of a steady, continuous, cumulative, and [in its most extreme form] a somehow preordained improvement in the material, social, cultural—indeed, the overall—conditions of life, and that its driving force is the expansion of human knowledge and power achieved by science and technology.

A page later, he stresses its distinction from what would follow.

What made the Seminal form of the Enlightenment commitment to progress so different [from the more recent concept], indeed, was an accompanying vision of radical political liberation. Marx and Smith see Thomas Jefferson's insistence on the equal importance of moral and material improvement as typical of the Enlightenment vision.
Progress, for Jefferson and like minded 18th-century thinkers, depends on continual human efforts toward personal and political liberation, toward the formation of virtue in the citizenry of the new Republic. To be sure, progress also flows from the scientific and technical endeavor, but care must be taken not to upset the balance between these two elements.  

Sometime after the turn of the 19th century, however, a marked shift in the rhetoric of progress becomes evident. Slowly but perceptibly, the belief in progress began to shift away from the moral and spiritual anchors of the revolutionary era toward a more utilitarian and hard-headed, business-oriented emphasis on profit, order, and prosperity.

(My emphasis)

Thus, Commissioner of Patents Thomas Ewbanks stresses the human capacity as manufacturer while giving short shrift to the Jeffersonian political ideal.

While most persons think not, and care not, what the prominent character of the planet is, many view it in aspects congenial to themselves: a theatre for politicians, a battle-field for warriors, a court for lawyers, a loungingplace for people of fashion and leisure, etc... while the Indian believes it was made for nothing else than hunting game in. With these, and all surface dreamers, its vast underground treasures are not thought of. The inorganic world, its forces, principles, and processes, are to them as if they were not. It is only as a Factory, a General Factory, that the whole materials and influences of the earth are to be brought into play.

(My emphasis)

Ewbanks is only one example of the rising rhetorical tide celebrating 19th-century America's technological triumphs that would culminate, as Marx puts it, in "a thoroughly technocratic idea of progress."

Helpful as these essays are for nuancing the changing character of progress talk, one could read them and overlook what seems to me to be the crucial characteristic of the 20th-century version, the radical human passivity implicit, (or, as in one Chicago exposition's rhetoric, explicit) in the concept of technology as an autonomous force at work in history. It would be possible to read Smith's "hard-headed business oriented emphasis on profit, order, and prosperity" as a celebration of man precisely as active, not passive, as conqueror of nature and creator of wealth. Thomas Ewbank's vision of man the manufacturer was hardly unique. How, then, might we explain the shift from man as active and aggressive to the passive and conforming man of the Chicago Exposition?

In their provocative essay, "The Mythos of the Electronic Revolution," Carey and Quirk propose an American shift from the encounter with nature as the Jeffersonian source of republican virtue, through a period of disillusionment with the social violence of steam-powered factory mechanization, to a new democratic ideal, which they name "the electronic sublime." Citing
a host of social theorists, from Patrick Geddes and the early Lewis Mumford to David Lilienthal and Marshall McLuhan, they point to a popular electronic dream promising "freedom, decentralization, ecological harmony, and democratic community"—in short, the very combination of political liberty and scientific-technological progress seen in Jefferson. Citing the same array of authors, however, Carey and Quirk underscore the ironic electronic reality that has subverted the enlightenment dream. Thus, for McLuhan, "electromagnetic technology requires utter human docility and quiescence" (my emphasis).

Helpful as it is, Carey and Quirk's reading of these contradictory strands in twentieth-century electronic ideology places too much emphasis on a single source for the shift toward passivity. Electronic systems, though clearly important in their own right, are better understood as one among a host of social and technological developments that, beginning as early as 1890, foster a vision of human passivity in the face of scientific and technological progress.

Gilded-age America, for all its enchantment with protean technological triumphs, was racked with urban violence. Bloody confrontations between workers and management police—from the Molly Maguires of 1976 through the railway strikes of 1894—were covered in lurid, and generally antiworker, detail in the national media. Millions of immigrants from the hitherto unfamiliar countries of eastern and southern Europe flooded the nation with what seemed to many to be hordes of frighteningly un-American strangers. At the same time, American inventiveness in the area of standardized system design (rails, telegraph, telephone, and electric utilities in particular) marked the rise to cultural dominance of a technological style based on solving problems through complex standardized systems and the gradual replacement of an earlier style that depended on the more political process of negotiation among technological practitioners, workers, and local citizenry.

Examples abound. Consider, for instance, the change in technological style both embodied and fostered by the railroad. In its first half-century of existence, the typical railroad evolved from the turnpike model—state-owned and state-supported roadbed—to a private, centrally owned enterprise that included roadbed and most system components. In the process, the relationship of railroads to their surroundings changed dramatically. Historian J. L. Larson provides an example by contrasting the design of grain-shipping facilities in St. Louis and Chicago in 1860. The St. Louis design demanded bagging the grain, loading it onto train cars, off-loading it at the outer edge of town where the tracks ended, teamstering it across the city and loading it again onto river boats. The Chicago design permitted bulk loading onto grain cars because the company-owned track ran all the way to the docks, where it was off-loaded onto grain boats. Larson concludes his description with the following provocative sentence:
If the Chicago system was a model of integration, speed, and efficiency, the St. Louis market preserved the integrity of each man's transaction and employed a host of small entrepreneurs at every turn—real virtues in ante-bellum America. 16

The St. Louis setup required negotiation as a part of the shipping process, whereas the more complex and capital-intensive Chicago design achieved greater efficiency and permitted railroad management to ship grain without needing to negotiate with that "host of small entrepreneurs at every turn."

In like fashion, the American factory system transformed the relationship between manager and worker from the sometimes respectful and sometimes tumultuous interaction of the early American small shop to heavy-handed enforcement of work rules coupled with the deskilling of workers through the use of increasingly automated machines. 17

The kinds of negotiation—highly skilled workers with owners, or local businessmen with national rail lines—preempted by the newly rationalized systems were a messy, unpredictable affair, often calling for high levels of political skill to achieve technical results. The new standardized systems, then, modeled the ability to exert control of unruly variables through elegant system design for a nation beset with troublesome signs of impending social chaos. It is not surprising that those Americans who sought a return to social order would look to the same scientific and technological prowess for an answer. Thus, in 1898, leading sociologist Edward Alsworth Ross urged "the right persons" (i.e., social scientists) to undertake "the study of moral influences. . .in the right spirit as a basis for the scientific control of the individual" 18 (my emphasis). Ross warned against revealing these scientific secrets for "to betray the secrets of social ascendancy is to forearm the individual in his struggle with society."

Seen from this perspective, Progressive-era reformers take on a new significance. Their commitment to "rationality" and "science" as the chief means for attaining the new social order marks the definitive end of an earlier era's assumption that political negotiation lay at the heart of the American dream. Robert Bellah and his coauthors of the recent Habits of the Heart describe the change in striking terms:

This desire for a more "rational" politics, standing above interest but based on expertise rather than wisdom and virtue, moved American political discourse away from concern with justice, with its civic republican echoes, toward a focus on progress—progress defined primarily as material abundance. 19

(My emphasis)

As Marx and Smith have indicated, the movement to define progress in terms of material abundance begins well before the Progressive Era. What is new, then, is the gradual abandonment of trust in the interactive creativity of...
human beings as the source of political cohesion and national self-identity. At the turn of the century, that confidence begins to be replaced by trust, not so much in the "scientific experts," as in the "Science" they represent.

On another front, the Ford labor reforms of 1914 countered the previous year's astonishing 370 percent turnover among workers on the company's nearly complete, moving assembly line with a mixture of in-factory spies and home-visiting inspectors aimed at producing stable, conforming, and Americanized workers for the company. Ford's mix of enforcement and paternalistic betterment programs, perhaps the most successful of prewar attempts at "Scientific Management," proved to be an early version of postwar control tactics seen in the Red Scare of 1919–20, tear gas in 1923, industrial psychology, and welfare capitalism plans throughout the 1920s.

Perhaps most striking of all, a dramatic shift in the character of advertising took place in precisely the same time frame. Nineteenth-century advertisements often took the form of a dialogue that assumed a basic equality between advertiser and reader wherein sales were thought to result from a rational dialogue about product qualities. World War I marked the rise to prominence of a style focusing, not on product qualities, but on what the product could do for the consumer. Advertising rhetoric was aimed at a consumer who was presumed to be irrational and basically inept. Roland Marchand describes the basic mentality:

In viewing the urban masses, advertisers associated consumer lethargy as much with weak-kneed conformity as with cultural backwardness. . . . Emotional appeals succeeded because only by seeking this lowest common human denominator could the advertiser shake the masses from their lethargy without taxing their limited intelligence.

In summary, the shift in progress rhetoric from a vision of man as aggressive conqueror of nature and creator of wealth to the present century's passive conformist results not from the symbolic power of a single technology, as Carey and Quirk suggest, but from an obsession with social, scientific, and technological control pervading level after level of national life. Just as inventors and entrepreneurs embodied the advance of progress in standardized system designs, so advertisers, social psychologists, and corporate managers worked to standardize the interior motivation of workers and consumers in their quest for a stable social order. As the 1933 Chicago Exposition indicates, not even the Depression's massive economic collapse would significantly change the core ideological premise of the new vision of progress. "Progress" had come a long way from the founding fathers' Enlightenment vision with its confidence in the capacity of human beings to transform nature for their benefit while negotiating a liberating political order. By 1930 "Progress" implied radical human passivity in the face of the twin gods, "Science" and "Technology."
Autonomous Progress and the Split of Method from Context:

From Descartes to Capitalism:
The Philosophical Tradition

Still, this remarkable transition from Enlightenment creativity to 20th-century passivity may not be as surprising as it seems. The ideal of progress traces its philosophical origins at least back to Descartes. Latent in that tradition we can see a central premise that, while originally masked by Enlightenment optimism about the scientific, technological, and political endeavors, provides another strand in the explanation of how Americans came to see Science and Technology as autonomous social forces and themselves as conformists.

Descartes posited a radical disjunction of valid method from human context, a supposition that may well prove the most important single assumption governing the West's commitment to progress as its primary historical model. To understand its influence on popular discourse let us briefly consider how it operates in the theories of three seminal thinkers—Descartes himself, Francis Bacon, and Adam Smith.

Rene Descartes

Descartes' famous "cogito ergo sum" ("I think, therefore I exist") followed from his first methodological principle, that the beginning of all valid cognition is to prove, rather than receive and trust, one's existence. The unreliable experiential context must be doubted in every possible way on the analytical journey toward that certitude Descartes sought so urgently. More than most earlier philosophers, he reveals an almost addictive penchant for certitude or, as he put it, "clear and distinct ideas."  

The Cartesian premise, a radical split of method from context, operates as the conceptual core of the ideology of autonomous progress. It assumes that the scientific method generates "value-free knowledge" precisely because, and only insofar as, it is practiced in isolation from its context. The nonscientific values of the wider human culture and the personal biases of the scientist must not critique or impinge on what Mario Bunge calls "the free and lofty spirit of pure science."  

Within the ideology of determinism, technology shares in science's methodological power because it is nothing more than the application of science. Both the applied science position and my critique of it are complex. Put in its simplest terms, we should note that the position rests on the premise that the controlled-variable scientific method provides the unique source of objective and value-free knowledge, a premise that relegates all other forms of cognitive behavior to the status of nonknowledge; that technology holds a "middle ground" between science and nonknowledge because it applies already extant Scientific knowledge to technical problems or it approaches...
technical problem solving with a close approximation of the scientific method.

My critique addresses two major points. On the one hand, I dispute the claim that science can ever achieve the goal of purely objective and value-free certitude even though it rightly holds to that ideal. Consequently, the claim that science represents a cognitive method radically superior to all other forms of cognition (e.g., poetry, contemplation, Aristotelian logic, storytelling, etc.) because of its freedom from personal or contextual influences cannot be sustained. In particular, I argue that technological knowledge is both valid and distinct from the scientific process in that it necessarily combines theoretical (and normally quantitative) models with concrete and pragmatic judgments. Thus, the argument continues, just as the scientific method must not be impeded by the nonscientific bias of traditional beliefs and vested interests, so Luddite romanticism must not be allowed to hinder what Robert Heilbroner has called the "technical conquest of nature that follows one and only one grand avenue of advance."

**Francis Bacon**

More commonly, progress ideology is linked with Francis Bacon's theory that sees the scientific method as guarantor of the objectivity of knowledge in the face of the deleterious effect of four "idols of the mind" that have reduced prior forms of knowledge to bankruptcy. Bacon sees science as a "masculine" conqueror of nature (human nature and the larger natural order). Thus, for Bacon, science and nature do not relate to each other in a kinship of knower and known or, in the language I have been using here, of method and context. Baconian science controls and dominates nature. The following text from his "Temporis Partus Masculus" has become a locus classicus for the Baconian position.

> I come in very truth leading to you Nature with all her children to bind her to your Service and make her your slave.

Just as Cartesian cognitive theory denies any methodological role to the human context, so the Baconian interpretation of science reduces nature—that is, all knowable reality—to servitude in a scientific power relationship.

**Adam Smith**

The industrial capitalism of Adam Smith and the British Industrial Revolution embodies the same commitment, namely, that we must not interrupt or disturb the inner workings of the method—in Smith's case, the free market’s invisible hand—by contextual interventions from society. Smith stands at the head of a long line of capitalist apologists who, in their starkest forms of orthodoxy, even argue the debilitating influence of aid to the poor. Poverty, according to their argument, results from personal character deficiency. In
the calculus of the free-market mechanistic vision of the social order, the renewal of human creativity can only be guaranteed in society at large when the penalty for defective behavior is so severe that it serves as a driving motive for individual and competitive advancement. Thus, in his "Gospel of Wealth," Andrew Carnegie rejects indiscriminate charity for the poor because it encourages sloth.

It is not the irreclaimably destitute, shiftless, and worthless which it is truly beneficial or benevolent for the individual [rich man] to attempt to reach and improve. 31

More striking still, Herbert Spencer provides another example of the pure position:

The well-being of existing humanity, and the unfolding of it into this ultimate perfection, are both secured by that same beneficent, though severe discipline, to which the animate creation at large is subject: a discipline which is pitiless in the working out of good; a felicity-pursuing law which never swerves for the avoidance of partial and temporary suffering. The poverty of the incapable, the distresses that come upon the imprudent, the starvation of the idle, and those shoulderings aside of the weak by the strong, which leave so many 'in shallows and in miseries,' are the decrees of a large, far-seeing benevolence.32

(My emphasis)

Spencer's "large and far-seeing benevolence" operates as an inevitable methodological force (the "law" of the survival of the fittest) that, like the scientific and technological methods, must not be hindered by such contextual interventions as humanitarian concern for the destitute. His severe and pitiless law may represent the rhetorical high water mark of the Cartesian-Baconian split of method from context. Stated in brief, the principle argues that mankind must relate to every possible context for scientific, technological, and business praxis as conqueror and controller, rather than with the affection and humility of kinship. This separation of man as knower, maker, and entrepreneur from his context lies at the heart of progress ideology, a belief that scientific, technological, and business methods must be allowed to run by themselves as in capitalism's maxim, "laissez-faire."

My interpretation of the ideology of progress is perhaps unorthodox in emphasis. Nannerl O. Keohane's excellent survey of the origins and literature of the concept, for example, suggests that Descartes and Bacon provided the catalyst for gathering one set of earlier Greek and Judeo-Christian ideas into a progressive ideology. I agree and, indeed, I agree with Keohane's focus on the critical link between knowledge and control over nature. We diverge when Keohane identifies their commitment to the radically new method with "vigorous optimism."33 It is clear that the 17th and 18th centuries were
marked by an extraordinary expansion of activity in global colonization, organized scientific research, mechanized production technologies, and the birth of British and American representative government. Nevertheless, at the heart of this outburst of creativity, the Cartesian, Baconian, and capitalist laissez-faire principles sowed the seeds of doubt about the capacity of humans to interact with and benefit from their context. Indeed, Descartes and Bacon understood their first methodological task as that of overcoming the bankruptcy of the human intellectual endeavor. We have already noted Bacon's critique of the four idols of the mind. In Steven Goldman's memorable expression, "Bacon's most original contribution to Western thought" is his argument that "proper method . . . is the sole route to truth and proper method is impersonal, must be impersonal, because the single greatest obstacle to the achievement of true knowledge of nature is the activity of the human mind." Richard H. Popkins's discussion of Descartes makes a similar point.

One finds that Descartes himself expressed great concern with the scepticism of the time; that he indicated a good deal of acquaintance with the Pyrrhonian writings, ancient and modern, that he apparently developed his philosophy as a result of being confronted with the full significance of the crise \textit{pyrrhonienne} in 1628–29, and that Descartes proclaimed that his system was the only intellectual fortress capable of withstanding the assaults of the sceptics.

Like the early 20th-century Progressive movement in the United States, this European philosophical tradition seeks security from methodological expertise rather than in the rough-and-tumble interaction of the political order. Although hardly noticed at the time, the laissez-faire premise fosters a hothouse environment aimed at protecting the workings of method from the turbulence of the larger context in which it operates. So important is this concept for understanding our 20th-century struggle with passivity, that it merits further exploration.

\textit{Three Modes of Context}

The split of method from context operates on at least three levels; "context" can be understood as cultural, as natural, and as personal-affective. Let us consider each in turn.

\textit{Progress and Culture}

Progress talk implies that scientists, technologists, and business leaders must be freed from the often well-meaning but ultimately foolish meddling of extramethodological critique. An example from American labor history may shed further light on the matter. For historian Herbert Gutman, American factory workers, beginning as early as 1840, found their "preindustrial"
experience of work (as one part of life's larger cultural fabric—religion, family life, leisure, etc.) confronted by the rigors of the new factory system. Because they severed the connection between work and the rest of life, factory work rules became the battle ground for more than a century of labor-management conflict. Workers continually tried to adapt industrial work rhythms to life rhythms. Religious feasts, weddings, funerals, and other community events interrupted the regularity of factory life fostering a continual lament about absenteeism by factory masters. More important still, workers insisted on interrupting the regularities of daily work with frequent breaks for food, drink, and play. 35

This tension echoes and perhaps even stems from a phenomenon at once physiological and psychological, the contrast between reciprocal and rotary motion. The human organism is more at home with reciprocal motion with its alternating bursts of energy and moments of rest; organic energy releases in pulses rather than in a steady stream. Rotary motion, on the other hand, never stops. It is far the more efficient mode of machine power delivery because it avoids the wear and tear of stop-start reversals found in reciprocal motion. 36 Thus, for factory machines rotary motion is the ideal. Insofar as workers are seen as functional components of the machinery, they are expected to operate in rotary-motion style, yielding steady, uninterrupted output. But insofar as workers see themselves as human organisms, they seek a reciprocal style, interrupting bursts of activity with breaks. In other words, the factory system tends to isolate work, we might call it "method," from the context of the rest of life while workers tend to insert work into a single cultural fabric.

We can apply this labor history example as a metaphor for the larger question at hand. Like factory machines, progress ideology sees "Technology" as a single moving force whose optimal mode is unencumbered expansion. From this perspective, interventions from outside the technological dynamic are unfortunate interruptions, hindrances to the inevitable forward movement.

This concept retains a vigorous presence in contemporary discourse. Consider, for example, the following text found in a recent advertisement for the United Technologies Corporation. 37 It reflects the pure ideology of autonomous progress so elegantly that it is worth a close look.

Ethically, technology is neutral. There is nothing inherently either good or bad about it. It is simply a tool, a servant, to be refined, directed and deployed by people for whatever purposes they want fulfilled.

Note that the advertisement defines "Technology" as a single force. It is, however, an easily directed, and value-neutral tool for general human use. How, then, are we to understand technological critiques?
So fast do times change, because of technology, that some people, disoriented by the pace, express yearning for simpler times. They'd like to turn back the technological clock. It is fantasy. Life was no simpler for early people than it is for us. Actually, it was far crueler.

(My emphasis)

Because "Technology" equals progress, every criticism of any technology is reduced to a "longing for the primitive." Technology's unfolding dynamic comes to be identified with the passage of time itself and the reader is warned of the "utter folly" of attempting to "turn back the technological clock."

Turning backward would not expunge any of today's problems. With technological development curtailed, the problems would fester even as the means for solving them were blunted. To curb technology would be to squelch innovation, stifle imagination, and cap the human spirit.

(My emphasis)

"Technology," sole guarantor of human creativity, alone can solve technology's problems. The message? Don't get in its way!

The challenge for our times is to foster its continued progress, to use it wisely, to manage it for our own greater benefit and the enrichment of life for those who follow. The full promise of technology lies in its development and use to make things better for all.

(My emphasis)

The text ends with a pious denouement. We, whoever "we" are, must manage and use technology wisely, but not by hindering its advancement. And somehow progress will "make things better for all."

Note how the ideology of autonomous progress blurs the question of power. The identification of scientific, technological, and business methods with progress renders irrelevant the question: "Who makes the policy decisions that shape new designs?" All changes in science, technology, and business benefit humankind as a whole, so the question "Who wins and who loses?" has no

To be precise we should consider the split between method and context less as an absolute separation than as a one-way causal flow. Method (science, technology, or business) is understood to influence its social context for the better. It is only when elements from that context seek to influence the direction of the method that the disjunction is invoked. We find a similar pattern in the relationship between science, technology, and nature.

Nature and Progress

Carolyn Merchant's The Death of Nature traces the gradual shift in Western thought from a concept of Nature as bountiful goddess who provides for human needs while setting technological boundaries, to nature Seen partly as a female to be conquered and partly as a passive array of resources to be exploited. In recent centuries and to Western eyes, nature is rarely experi
enced as an interactive peer, and certainly not as a goddess. We find a partial exception, perhaps, in some 19th-century American engineers who saw "the wilderness" as a godlike force—admired, respected, dangerous, beautiful, and savage—even as they tried to conquer her.  

In fact, a theme of reverent affection for material reality runs through the technical traditions of the West operating in direct competition with the "method-is-all" mentality. Nevertheless, we see repeated signs of a twentieth-century technological style in the United States that preempts nature as a negotiating partner, where technical method dominates natural context. Thus, Los Angeles, unlike major nineteenth-century cities, is situated in a nearly total desert. The city's location rests on the belief that our technical systems allow us to transcend the water-constraints of the natural context. Air conditioning, which enables us to ignore the weather as long as we have enough energy to run our systems, provides a similar example. Most striking of all, of course, are our waste disposal and conservation styles, which now present us with a century of unpaid bills in such areas as acid rain and toxic pollution.

**Progress and Human Affectivity**

The domain of progressive method is not limited to the realms of nature and culture, but extends into the affectivity of those who practice the method themselves. Scientific and technical practitioners are supposed to work their methods independently of their own affectivity if science and technology are to operate with value-free objectivity. Personal bias must not influence the work. Once again, however, the method-context split operates in a one-way direction. Human affectivity can be analyzed by social science, programmed by advertising, and reshaped by the cultural changes resulting from adaptation to technological advance.

Recently, at a colloquium between humanist scholars and scientists from the Lawrence Livermore Laboratories, I encountered an example of the sensitivity of technical practitioners to questions of personal motivation. During the day-long discussion of the morality of nuclear deterrence, one participant asked how the biases of the technicians influenced their choices of research priorities. These were scientists who claimed to judge each weapon system according to its merits as part of the deterrence calculus. Might they push lines of research simply because of their innate enthusiasm for a given project or, worse, because they wanted to keep research going to safeguard their positions? To these ears, at least, the most outspoken Livermore scientists found the question itself distinctly uncomfortable. To suggest, as the question did, that their practice of science and technology might be influenced by nontechnical motives seemed to be understood as something close to an attack on their professional integrity.  

This exploration of the method-context disjunction, so central to the autonomous progress model, complements our earlier observations about
America's shift from an active to a passive human participant in the scientific, technological, and business endeavors. Seen from these dual perspectives the six-word motto of the Chicago Exposition is transformed from a puzzling Depression-era slogan into an extraordinarily deft summation of the long tradition of autonomous-progress mythology. "SCIENCE FINDS" the truths of nature. "INDUSTRY APPLIES" the truths that science has found; and the term industry combines both technological and business practice. The human beings who practice the methods of all three are, as we have seen, not understood to direct their disciplines. Their proper role, like that of the larger human culture and of nature, is passive. "MAN CONFORMS" indeed!

Critiques of Progress Talk

Thus far, I have frequently observed that the "progress talk" with which we are concerned does not include all discussion, indeed very little serious academic discussion, of the value or cumulative effect of Western scientific, technological, or business practice. I have been concerned, rather, with that element of such discourse that implies that these three methodological traditions operate as inevitable forces to which human individuals, human societies, and nature must conform. Before turning to some concluding suggestions for a more appropriate language, however, it will be helpful to gather together the critiques implicit throughout the previous discussion in order to explain, explicitly, why I see such progress talk as a destructive impoverishment of our language.

In what follows I will criticize the rhetoric of autonomous progress, and the philosophical disjunction of method and context on which it depends, on three counts. I will suggest, first, that progress talk distorts historical reality; second, that it fails on simple logical grounds; and third, that it operates as a destructive political force in society, both by legitimating several centuries of Western colonialism and by its now-familiar tendency toward political passivity.

Historical Critique

Progress talk fails, first, on historical grounds. Historians of science and technology do not deny the existence of an ideal of scientific and engineering objectivity, the attempt to put one's work in the service of one's discipline and in the process to rise above mere self-interest. Even so, the claim that these methods operate in some historically abstract universe, generating value-free knowledge or value-free technical designs simply cannot be verified by the historical record.
Thus, for example, metallurgist and historian of technology Cyril Stanley Smith argues against the rhetoric of purely rational objectivity in the practice of science:

It is high time that scientists admit that their experience in the laboratory is an aesthetic one, at times acutely so: the and form of presenting their results has disguised this, and their respectable logical front often makes it invisible even to a student. 42

More radically, however, it has become a commonplace among historians of science and technology that every scientific or technical artifact embodies the values and world view of its designers and maintainers.43 Indeed, the ideology of autonomous progress is radically antihistorical at its core. If technical designs and scientific theories advance according to an inevitable interior logic, then the historian's labor of identifying the people and institutions who were decisive at any stage of either activity, of situating those actors in the specifics of their historical context, is essentially meaningless.44 History becomes uncritical hagiography wherein the heroes of progress are celebrated for their contributions to the inevitable advance of humanity rather than studied for their influence on the shape of these essentially human endeavors.

Logical Critique

The rhetoric fails on logical grounds as well. Thus the sentence, "Technology advances," flounders between the generality of the subject, "Technology," and the specificity of the predicate, "advances." By contrast, the statement, "Internal combustion engine design advanced, between 1900 and 1930, in terms of compression ratio," is specific. I have identified the technology as well as the criteria determining which direction is forward. When it stands alone, however, "Technology" is a general term covering all those designs by which humans solve problems. It includes artifacts as diverse as hoes and shovels, steam engines, nuclear weapons, electric light and power systems, and electric toothbrushes. To speak of "Technology" in the singular, with a capital "T," and to say that it advances can only mean that whatever is done is forward. Liking or disliking progress is hardly the issue. Once the inevitability of the advance has become embedded in my language, my judgments about its values have been rendered pointless.

Political Critique:

Legitimation of Colonialism

"Progress" began in the West, a circumstance laden with destructive consequence for non-Western societies. In the name of progress, "the white man's burden" as it has often been called, citizens of the West have justified...
and even beatified at least two centuries of colonial exploitation, continuing into the present. Westerners justified their deeds as serving the advance of civilization; we were helping others catch up. This dynamic, most visible in cross-cultural colonialism, also operates inside industrialized countries with minorities such as blacks and Native Americans in the United States and "Luddites" in 19th-century Britain. Arthur Goldschmidt exemplifies the attitude in his description of how local culture inhibits the advancement of society through Western technology transfers.

Technical assistance personnel find the transfer of existing technology easier in the advanced sectors of the dual economies of the underdeveloped world, since there is generally no cultural barrier to be breached, no question of resistance and receptivity, . . . The witch doctor's objection to penicillin, the landowner's rejection of agricultural machinery, the merchant importer's opposition to indigenous industry. . .have greater relative significance [than in developed countries].

(My emphasis)

Note the classic progress language: "advanced" and "underdeveloped." Goldschmidt's cultural barrier, "the social and economic structure," is seen as the enemy of Western progress.

We see the same mentality in the following poignant statement by James McLaughlin, Indian Agent for the Lakota Sioux, in 1889:

To put the raw and bleeding material which made the hostile strength of the plains Indian through the mills of the white man, transmuting it into a manufactured product that might be absorbed by the nation without interfering with the national digestion.

**Political Critique:**
**Passivity in the Western Body Politic**

Finally, the ideology of progress can be critiqued in terms of the passivity it fosters among its own mainstream constituency. Because progress advances inevitably, it is understood as a force that influences, but is not influenced by, the society in which it originates. Although the culture cannot critique scientific, technological, and business methods, these same methods will gradually analyze (science) and transform (technology and business) the culture itself. The culture must "catch up" with progress.

The rhetoric of citizen passivity seen in the 1933 Chicago Exposition has proved remarkably durable over the decades of this century. We find it in contemporary advertisements, in commonly accepted descriptive categories such as the HEGIS code, on the text boards of our leading museums. Illogical and ahistorical though it is, the rhetoric of autonomous progress exerts continuous pressure on our imaginations as we, citizens of the body politic, wrestle with the inherently political decisions by which we allocate
our scarce resources in pursuit of our various and value-laden scientific, technological, and business projects. In the brief space available here I will suggest an alternative language, one that takes into account the cumulative impact of successful technological designs while avoiding the radical passivity and implicit cultural arrogance of the model we have considered thus far.  

**An Alternative Language**

The alternative language is based on the historical reweaving of technological artifacts and their contexts. Historians of technology labor to situate each artifact within the limited, historically specific, value domains from which they emerged and in which they operate. They speak of "technologies," and not "Technology," of cultural options rather than inevitable progress. This approach attempts what history traditionally holds dear, the liberation of human beings by demythologizing false absolutes and by paying attention to the human context of change.

Successful technologies happen more by choice than by fate. Human beings with their tangled motives, not abstract inevitability, decide which designs are attended to and which ignored and why the technologies found worthy of inventive and fiscal attention take the final shape they do. This maxim, the central tenet of contextual history of technology, provides a basis for understanding technological style. Because a technical design reflects the motives of its design constituency, historians of technology look to the values, biases, motives, and world view of the designers when asking why a given technology turned out as it did. Every technology, then, embodies a distinct set of values. To the extent that a technology becomes successful within its society, its inherent values will be reinforced. In this sense, every technology carries its own "style," fostering some values while inhibiting others. In the technological view of history tradeoffs abound. There is no technological "free lunch."

To take the matter one step further, we might note that the men and women with access to the venture capital that successful technologies always require in their early stages tend to be the same people who hold cultural hegemony in their society. "Holding cultural hegemony" means belonging to that group of people who shape the dominant values and symbols of their society. Although they never form a single historically tidy group, as a technological conspiracy theory might suggest, they do tend to view the world from the same perspective. Consequently, we can look for a set of successful technologies that, in any relatively stable era of history, embodies the "technological style" of its society. It would be oversimple to Say that technological style operates as the sole cause of prevailing cultural values such as those noted in our earlier discussion of the passion for systemic
controls during the first three decades of this century. The values embedded in successful technologies originate in the world view of those who design and maintain them. Still, it would be equally oversimple to say that technologies exert no influence on the values of their host society. If technological designs are not value-neutral, and this is the central premise of the approach taken here, then their very success, the many ways that their host society comes to depend on them and adapt to their constraints, operates as an amplification of their inherent values.  

When the discussion of technological change has been rescued from the abstract ahistoricity of progress talk, it becomes clear that technological decisions always involve power relationships. Every technical choice—to invest inventive, developmental, or entrepreneurial attention in any given design, and to bring venture capital to bear on the endeavor—allocates scarce resources within the local, national, or global body politic. Which citizens have access to the design process? Whose values are embodied and whose ignored in the systems that become economically and politically successful? Questions such as these lie at the heart of any historically valid technological discourse.

It follows, then, that how we think and talk about technology influences our political as well as our intellectual stance. Insofar as we retain the linguistic habits of progress talk, we define ourselves as passive drifters on the technological tide. By doing so we choose to split our analyses of technology off from our responsibilities as actors in the socioeconomic-political drama. This, it seems to me, is the primary justification for the detailed rhetorical analysis just concluded.

One final note. Conformity, the whipping boy of the previous analysis, is not always a bad thing. Systemic conformity serves as a societal virtue—we often call it "civility" or "civic responsibility"—whenever the members share a consensus about the goals served by the system's design. Without it, in fact, communal life in a complex, system-structured society becomes unmanageable. On the other hand, should we live in a time when our consensus about how to define the common good requires renegotiation, we must be particularly careful about our technology talk. At times like that, choosing passive conformity merely hands the task of shaping technological consensus over to others. Do we live in such an era? Some interpreters of our present circumstances, myself included, think that we do.  

But even to raise such a question, asking whether we live in a time when conformity to existing technologies is more or less constructive civic behavior, demands a language and an epistemology that define the technological endeavor in terms of its sociopolitical, and not merely its technical dimensions. Valid technological knowledge, in short, calls for an integration of quantifiable and precise theory with that form of cognition often called "intimacy," the capacity to pay attention to and find meaning within the messy inconsistencies of the larger contextual reality.
A historically critical interpretation of technology, then, demands reading the signs of the times. Responsible technology talk fosters a language of engagement, where "Technology" is understood to be a variety of particular technologies, each carrying its own embedded values, each relating to its own unique cultural circumstance. It is a language that reweaves the human fabric, reintegrating method and context, and inviting us all, technical practitioners and ordinary citizens alike, to engage in the turbulent and marvelous human endeavor of our times.

Notes


2. Chicago Century of Progress International Exposition, *Official Book of the Fair*, (Chicago: A Century of Progress, Inc., 1932), p. 11. The earlier quote on lighting occurs on p. 21. Later, on p. 25, we find an even more stunning encomium to the exposition's lighting wizardry: "Should you gasp with amazement as, with the coming of night, millions of lights flash skyward a symphony of illumination, reflect again that it is progress speaking with exultant voice of up-to-the-second advancement."

I am indebted to Lowell Tozer's "A Century of Progress, 1833–1933: Technology's Triumph Over Man," *American Quarterly* 4, No.1 (Spring 1952): 78–81, for first calling my attention to the Exposition and to Cynthia Read-Miller, curator of photographs and prints in the archives at the Henry Ford Museum and Greenfield Village, for copies of the Official Book and photographs of the iconography referred to below. For texts and photos from the Guidebook see Appendix 1.


5. Recent examples of pure progress talk will be cited below for two reasons. On the one hand they provide texts for analysis of the details of the position I have sketched out above. On the other, they constitute evidence that the rhetorical pure position remains alive and well in popular discourse today.


8. "When they spoke of progress, as they often did, they consequently gave equal weight to human betterment (intellectual, moral, spiritual) as well as material prosperity. Without betterment, prosperity was meaningless. The pursuit of science and the development of technology doubtlessly occupied an important place in this scheme of things. But as means to larger social ends, they assumed a lesser order of magnitude in the Jeffersonian scale of values." Merritt Roe Smith, "Progress," p. 4.
9. Ibid., p. 4.


11. Marx ("Heidegger," p. 649) defines "technocratic" as "a commitment to the sufficiency of technical solutions or, in other words, the belief that if the means are perfected the ends will take care of themselves." Marx and Smith both call attention to the occasional critic of unabashed technical optimism (Hawthorne, Thoreau, the later Emerson, etc.) but stress their distinct minority position in popular rhetoric.


Marx's analysis of Heidegger's concept of "enframing" stresses the same aggressive quality noted in Smith's essay. Thus:

"Enframing, the revealing the rules through modern technology, is far more aggressive, intrusive, extractive, not to say rapacious than earlier modes of revealing" (Heidegger, p. 641; my emphasis).

In what follows I will adopt the admittedly sexist use of "man" for "human" both because the usage is commonplace in the rhetoric under discussion and because it reflects the stereotypical division of gender into the separate spheres that underlies this whole mode of thought.


15. See John Higham, Send These to Me: Jews and Other Immigrants in Urban America (New York: Atheneum, 1975), for a broad overview of legal and social resistance to immigration from 1870 through the draconian 1924 immigration act that marked the definitive end of the earlier open-door policy. On the origin and later history of the popular image of "The Melting Pot," see Philip Gleason, "The Melting Pot: Symbol of Fusion or Confusion?" American Quarterly 16, no. 1 (Spring 1964): 20–46.


17. The most helpful single source on changing labor-management relations in 19th-century America remains Herbert Gutman's Work, Culture and Society in Industrializing America (New York: Vintage, 1966), esp. the title chapter.

For a more detailed study of the growth of standardization as a technological ideal, together with a correlative decline in the more political ideal of negotiation as a means of solving social problems, see my "The Politics of Successful Technologies," in Stephen Cutcliffe and Robert Post, In Context: History and The History of Technology—Essays in Honor of Melvin Kranzberg, Bethlehem, Pa.: (Lehigh University Press, 1988).


23. We should not, however, overlook the strength of the Carey and Quirk hypothesis. Electronic technologies, as Henry Adams intuitively observed in his famous "Virgin and Dynamo" essay, present a radically new, quasi-mystical technological ideal qualitatively different from the more immediately obvious and sensual technologies of the preelectronic machine age. For an elegant argument of the symbolic importance of the shift from a gear-and-girder to an electronic technical ideal, see the preface of Cecelia Tichi's *Shifting Gears: Technology, Literature, Culture in Modernist America* (Chapel Hill: University of North Carolina Press, 1987), pp. xi–xvi.

24. This year's bicentennial celebration of the Constitution serves as a vivid reminder of the founding fathers' extraordinary confidence in their ability to craft a new social order. They would, I suspect, be dismayed were they to witness the emergence of the doctrine of conformity in the 20th-century version of belief in progress.

25. Richard H. Popkin provides the broad philosophical and theological context as well as the detailed personal circumstances that render Descartes's extreme need for certitude intelligible; see *The History of Scepticism from Erasmus to Descartes* (Assen, The Netherlands: Koninklijke Van Gorcum & Comp. N.V. Assen, 1960), esp. chaps. 9, 10)

For an insightful analysis of the Cartesian assumption as it has influenced Western science, see Evelyn Fox Keller and Christine Grontkowski, "The Mind's Eye," in *Discovering Reality* ed. Sandra Harding and Merril B. Hintikka (Dordrecht, The Netherlands: D. Reidel, 1983), pp. 212, 214. Keller and Grontkowski situate the Cartesian disjunction in the much longer Western tradition of Greek philosophy. On the other hand, for a portrayal of Greek ambivalence about scientific and technological progress in the dramatic poetry of Aeschylus, Sophocles, and Euripides,


26. For this text and a detailed articulation of the autonomous science position, see Mario Bunge, "Technology as Applied Science," *Technology and Culture* 7, no. 3 (Summer 1966): 329–47.

27. Lest this overly simple sketch of my position be misunderstood, let me hasten to note that my critique of the controlled-variable method pertains only to what is sometimes called "Scientism," namely: (a) claims for its ability to overcome all bias and achieve a form of absolute certitude and (b) the consequent claim that other cognitive traditions are nonknowledge. The value of the ideal of precision and objectivity for limiting the influence of bias in scientific traditions is, I take it, obvious. It is, however, one thing to seek precision and objectivity as an asymptotic ideal and quite another to assert its absolute achievement in the face of historical evidence to the contrary. For references to some of that evidence see n. 43 below. I see science, in short, as a very welcome member of the family of human cognitive traditions but not as the one and only valid way toward truth.

Finally, for a much more thorough presentation of all this see my *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge: The MIT Press, 1985), chap. 3 and esp. pp. 96–99.

28. The original Luddites were 19th-century British textile workers who selectively destroyed those new machines that they judged damaging to themselves. In progress talk the term "Luddite" is often used to stigmatize those whose fear of change leads them to reject technological advances of any sort. See David E Noble, "In Defense of Luddism," *Democracy* 3, nos. 2, 3, 4 (Spring, Summer, Fall, 1983) but esp. no. 2 (Spring): 8–24, and Adrian J. Randall, "The Philosophy of Luddism: The Case of the West of England Woolen Workers, ca. 1790–1809," *Technology and Culture* 27, no. 1 (January 1986): 1–17.

For the text just cited, see Robert L. Heilbroner, "Do Machines Make History?" in *Technology and Culture* 8, no. 3 (July 1967): 337. For my detailed critique of Heilbroner's position, see *Storytellers*, pp. 140–43.

One further example of the commonplace description of technology as applied science can be found in the HEGIS Codes for academic disciplines. The subheading "Engineering and Technology" is defined as follows: "Includes those subject field designations associated with the practical application of basic scientific knowledge to the design, production, and operation of systems intended to facilitate man's control and use of his natural environment." Note that, in addition to the expression "application of basic science," the HEGIS classification adopts other code words from the ideology of autonomous progress, in particular "control . . . of his natural environment."

29. The four idols are: (a) "idols of the tribe" (the tendency to stress only that evidence that affirms one's theory); (b) "idols of the cave" (the personal bias of each person); (c) "idols of the market-place" (the biases embedded in ordinary and
unquestioned language); and (d) "idols of the theater" (the biases inherited from our educational training). For an illuminating
discussion of the overall position as well as a contrast with the Renaissance nature philosophy against which Bacon fought, see
Steven L. Goldman's "From Love to Gravity: Renaissance Nature Philosophy versus Modern Science," unpublished manuscript,
Lehigh University, Bethlehem, Pa. Or see James Collins A History of Modern European Philosophy (Milwaukee: Bruce, 1954),
pp. 54–57.

30.


For a discussion of the link between the ideology of autonomous progress and Adam Smith's invisible hand, see Langdon
Winner, Autonomous Technology: Technics-out-of-Control as a Theme in Political Thought (Cambridge: The MIT Press, 1977),

M. Chodorow, and R. H. Pearce (Berkeley: University of California Press, 1977), pp. 21–40. For other helpful overviews of the
European progressive tradition, see Nisbet, "History of the Idea of Progress," and Howard Segal, Technological Utopianism in
American Culture (Chicago: University of Chicago Press, 1985), chap. 4 This is also discussed in Goldman's "Science, Philosophy
(Pennsylvania State University Press, n.d.).


36. I am indebted to the late Lynn White Jr. for this observation about the nonorganic quality of rotary motion. See his Medieval


38. For a more complete discussion of the question of power relationships in technological decision making, see my "The Politics of
Successful Technologies."


40. See, for example, Elting E. Morrison, "The Works of John B. Jervis," in his From Know-how to Nowhere: The Development of

the conference. Participants came primarily from the Lawrence Livermore Laboratories, the University of California at Berkeley, and
the Graduate Theological Union of Berkeley.

http://flyers.udayton.edu/search~S0?/tscience%2C+technology+and+soc…064&FF=tscience+technology+and+social+progress&1,1,1,0/indexsort=-

43. Such critiques pervade recent history of science where the claims of objective and value-free science are challenged by studies of the political and economic factors influencing the content and methodology of science. See, for example, Arnold Thackray, "The History of Science," in *A Guide to the Culture of Science, Technology, and Medicine*, ed. Paul Durbin (New York: Free Press, 1979), and Roy MacLean, "Changing Perspectives in the Social History of Science," in *Science, Technology, and Society: A Cross-Disciplinary Perspective*, ed. Ina Spiegel-Rosing and Derek De Solla Price (Beverly Hills, Calif: Sage, 1977). For studies of psychological and philosophical influences on the content and method of science, recent "gender and science" literature is particularly important. Evelyn Fox Keller has developed this perspective most thoroughly and insightfully. See her *A Feeling for the Organism: The Life and Work of Barbara McClintock* (San Francisco: W. H. Freeman, 1983), and *Reflections on Gender and Science* (New Haven: Yale University Press, 1985).

For an overview of similar critiques concerning the influence of bias on research and development and technological design in the history of technology see my *Storytellers*, passim but esp. chap. 1 and 5. For a gender and technology perspective, see Joan Rothschild, ed., *Machina ex Dea: Feminist Perspectives on Technology* (New York: Pergamon Press, 1983), esp. her introduction.

44. Arnold Gehlen demonstrates the point in the following passage. "Technology [can hardly be seen as] the product of a conscious human effort to extend material power, but rather as a large-scale biological process by which the human organism's innate structures are impressed onto the human environment to an ever greater extent: a biological process, in other words, which because it is just that, is beyond the reach of human control. Both types of process, technological progress and biological development under the pressures exerted by the industrial system, have entered a phase of incalculable endlessness, and this alone compels us to call the era in which we live . . . a post-historical phase. "Über kulturelle Evolution," cited in Reinhard Rurup, "Historians and Modern Technology: Reflections on the Development and Current Problems of the History of Technology," *Technology and Culture* 15, no. 2 (April 1974): 164.


46. For a study of the influence of this Western bias on the research preferences of mainstream historians of technology, see *Storytellers*, pp. 26–34, and 178–79.

47. Source unknown. The text appears as part of a photographic exhibit of the Lakota people by Donald Doll, S.J.


49. Thus, for example: "The same technology can be used to launch satellites or warheads. Technology itself has no moral dimensions. It is neither good nor evil. The use to which technology is put is determined by mankind for political, economic, and social reasons" (wall plaque in Space Hall next to the Jupiter C, Scout D, Minuteman III, and Vanguard missiles in the National Aerospace Museum, Washington, D.C.). On the HEGIS code, see note 28 above.
50. For the sake of simplicity I will omit further treatment of the ideology of progress as it relates to science and business and concentrate exclusively on technological designs.

51. See my "Storytellers" (chap. 5) for evidence that historians of technology have succeeded in this contextual interpretation of technological change and for counterevidence that they themselves been influenced by the ideology of autonomous technological progress in their choice of research subjects.

52. On the tradeoffs inherent in technological style, see Thomas P. Hughes, "We Get the Technology We Deserve," *American Heritage* (October–November 1985): 65–79.


54. For a more complete discussion of technological style and the entire model proposed here, see my *Storytellers*, pp. 192–201 and "The Politics of Successful Technologies."

55. See, for example, Bellah et al., *Habits of the Heart*. The authors present compelling evidence of America's individualistic incapacity for and need to renegotiate a vision of the common good. I have argued the same point in my "United States Technology and Adult Commitment," *Studies in the Spirituality of Jesuits* (St. Louis: Seminar on Jesuit Spirituality, 19, no. 1, January 1987).