

Science and Technology: Who Gets a Say?

John M. Staudenmaier, S.J.

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In recent years historians of technology have increasingly agreed on one major question about the relationship of science and technology. Technology's intellectual character cannot be reduced to "the application of science," as if science created real knowledge and technology then applied it to solve problems. Technological cognition, its own unique form of knowledge, takes shape in a tension between generalizable knowledge (called "theory" these days and "know-how" in an earlier era) and the technical practitioner's capacity for pragmatic judgments. These one-of-a-kind decisions are based on intimate knowledge of the immediate situation (often called "skill" or simply "experience").¹

This suggests that longing for clearly-defined controlled environments, for non political "sweet" projects, may be the engineers' primary seduction. When overcome with hankering for Faustian bargains engineering loses its balance and becomes brittle. Healthy technological thinking, even at its most sophisticated "high-tec" levels, engages the messy unpredictabilities of the situation at hand as an essential component for creativity and does not flinch from them as unwelcome interruptions in the design process.²

Put another way, technological thinking includes something more than "rationality" or, as David Landes puts it, "the adaptation of means to ends."³ It requires an intimacy with the societal and cultural context that both transcends and anchors means-to-ends strategies. It must provide a context of meaning within which means-to-ends strategies make sense, wherein some strategies get accepted as worth the time and money. This insight lies at the heart of a contextual approach to the history of technology. One cannot understand any technology, so contextualism argues, unless one studies how the design works (i.e., its means-to-ends rationalizations) and how its societal context explains why this particular design came to be invested in at all.⁴ Increasingly, this contextualist insight has become legitimate within the history of science where, again, the motives

and world view and vested interests of scientists have begun to be respected as significant evidence for interpreting the resulting science rather than dismissed as peripheral exogenities.⁵

It would seem, then, that the question of how the means-to-ends rationalities of scientific theory and technological design relate to their contexts has been pretty well settled. It may be, however, that the ghosts of a David Landes vision of Western science and technology have not vanished from the field. Enlightenment elitism that defines every sort of thinking that cannot be reduced to means-to-ends strategy as "superstition" has flourished for several centuries because, and this is the point of interest here, it provides substantial benefits to scientific and technological practitioners. One takes a short step indeed from the claim that true science and technology must be allowed to operate free from irrational or self-serving outside influences to the claim that scientific and technological practitioners must be allowed to operate free from any objection or critique by those outside their domains of expertise.⁶ It is not by chance that Adam Smith's capitalism came to prominence just as science and technology began to be treated as autodynamic enclaves of pure rationality and beneficent "progress." Whether applied to the market, to science, or to technology, Laissez Faire's iron law--"never interrupt the working of the method by outside critique"--resides in Western consciousness at the primordial level of symbol and rhetoric. Despite the recent critiques noted above, it's seductive charms continue to tempt us. Such, at least, is the premise from which this paper proceeds.

In what follows I will sketch some parts of a complicated story, asking how it came to be that such a chasm opened between those who design, manage and decide the shape of society's dominant systems and the ordinary citizen who has learned to conform to what has already been settled in private. I will approach the question by calling attention to the architecture of two factories, Jeremy Bentham's Panopticon and Henry Ford's River Rouge. Both acquired the status of an archetypal symbol of modernity and both reveal a central paradox for the modern West, namely, that capitalism, for all its celebration of aggressive individual creativity and initiative, turns out in practice to create systems whose designs require passive conformity for the vast majority of those who encounter them.⁷

I. The Bentham Panopticon: The Invisible Watcher as the New Locus of Power

Morals reformed--health preserved--industry invigorated--instruction diffused--public burthens lightened--Economy seated, as it were, upon a rock--the gordian knot of the Poor-Laws not cut, but untied--all by a simple idea in Architecture!---- Thus much I ventured to say on laying down the pen--and thus much I should perhaps have said on taking it up, if at that early period I had seen the whole of the way before me. A new mode of obtaining power of mind over mind. Jeremy Bentham⁸

Late in the 18th century Samuel and Jeremy Bentham designed the "Panopticon," a "12 sided polygon formed in iron and sheathed in glass in order to create the effect of `universal transparency.'"⁹ Samuel Bentham invented the plan as an ideal factory for peasant workers in Catherine the Great's Russia but it was his more prominent brother, utilitarian philosopher Jeremy, who promoted the idea with the entrepreneurial fervor of a missionary. He recognized that the model could be applied not merely to factories, but to any institution aimed at regulating the behavior of the unruly--orphans and the insane in asylums, students in school, workers in factories, or prisoners. In 1787 he began a several decade campaign for Parliamentary funding of a model prison, to be managed by himself at a profit, in which a marginal ring of transparent cells held isolated prisoners under the twenty-four-hour-a-day scrutiny from the opaque inspectors' tower.¹⁰

Bentham saw the prison as a factory ("a mill for grinding rogues honest and idle men industrious."¹¹) and scrutiny drove the mechanism for manufacturing reform.

". . . the more constantly the persons to be inspected are under the eyes of the persons who should inspect them, the more perfectly will the purpose of the establishment have been attained. Ideal perfection, if that were the object, would require that each person should actually be in that predicament, during every instant of time. This being impossible, the next thing to be wished for is, that, at every instant, seeing reason to believe as much, and not being able to satisfy himself to the contrary, he should conceive himself to be so."¹²

A radical imbalance of power divided invisible tower from isolated prisoner. As Michel Foucault observes:

"Bentham laid down the principle that power should be visible and unverifiable. Visible: the inmate will constantly have before his eyes the tall outline of the central tower from which he is spied upon. Unverifiable: the inmate must never

know whether he is being looked at at any one moment; but he must be sure that he may always be so . . . in the peripheric ring, one is totally seen, without ever seeing; in the central tower, one sees everything without ever being seen."¹³

Once imbued with the self image of living under the scrutiny of unseen eyes, twenty four hours a day, the prisoner could be released into society

Bentham intuitively grasped the nature of a profound revolution in the West's understanding of how the individual relates to the governing structures of society. His Panopticon plan abandons the earlier judicial focus on the criminal act (with its appropriate punishment) and concentrates on the criminal (and his/her need to be corrected). In the older way of doing things, if I am judged guilty of a crime I become liable to a specific punishment, but I am not defined as a defective human nor am I excluded from the larger human community in principle. As in the Greek term for sin, hamartia ("missing the mark"), my guilt has to do with the act I committed. Once my debt is paid, it is assumed that I have a place within the human community. This even holds in cases of capital punishment for societies that provided explicit reconciliation prior to execution. Once absolved, the repentant sinner died reunited with the community of the Church which, nevertheless, exacted the death penalty that accrued to the criminal act. Presumably, both executioner and the executed would hold common status in the heavenly community in which both believed and on which the practice was based.¹⁴

Bentham's plan abandons the assumption that crimes can be paid for by punishment without eroding the ordinary humanity of the criminal. The Panopticon redefines criminals as defective and needing correction. Foucault sees this shift from punishable act to defective character pervading nineteenth and twentieth century European penal practice; judges have "taken to judging something other than crimes, namely, the 'soul' of the criminal."¹⁵ Judging the interior of the criminal and applying corrective remedies implies some exterior standard against which one is measured and that in turn implies some person or group who get to set the standard.

The unstudied rhetoric of those who claim the elite status of therapist frequently reveals the depth of contempt for those deemed in need of repair that is implicitly part of this social arrangement. Thus Karl Menninger writes:

We, the agents of society, must move to end the game of tit-for-tat and blow-for-blow in which the offender has foolishly and futilely engaged himself and us. We are not driven, as he is, to wild and impulsive actions. With knowledge comes power, and with power there is no need for the frightened vengeance of the old penology. In its place should go a quiet, dignified, therapeutic program for the rehabilitation of the disorganized one, if possible, the protection of society during the treatment period, and his guided return to useful citizenship, as soon as this can be effected.¹⁶

One could ask, of course, how any group of human beings acquires the right to set standards for the correction of the character of other human beings. How do some human beings become "the" agents of society and members of this imperial "we," while others remain locked in the third person (i.e., "the disorganized one" who needs "our" guidance to be returned to useful citizenship)? The device of the invisible tower preempts such questions by masking the power relationships at work here. The desideratum of Benthamite incarceration is not a community wherein identifiable people negotiate the norms of acceptable human behavior. Instead, the Panopticon inculcates the experience of invisible scrutinizers who, indeed, need not be in the tower at all.

Echoes of Bentham: Computerized Scrutiny and Computerized Tests

Bentham bitterly regretted Parliaments refusal to implement his insight. Nevertheless, his basic concept has flourished in Western societies ever since, most vividly, perhaps, in George Orwell's 1984. Orwell mirrors the Panopticon with the omnipresent telescreens. His dystopian dictatorship, Oceania, scrutinized all citizens all the time to prevent those forms of mysterious and unpredictable freedom which can surprise and confound the state's planning. As in Bentham's prison, of course, one can never be sure whether "Big Brother is always watching" at any particular moment.

This same desire for omnipresent scrutiny as a form of control has been documented by Harley Shaiken and Shoshanah Zuboff. Shaiken has articulated the concept of "over computerization" by which he means the use of computers to increase managerial control at the cost of decreasing productivity and efficiency. Zuboff documents repeated instances of managerial

loss of nerve in the face of radically expanded access to computer data bases by all levels of the corporate hierarchy. Despite significant increases in productivity and efficiency that follow such open access policies, democratization of information access is often aborted by acts of autocratic revisionism on the part of upper management.¹⁷

On a more mundane level, an even more significant instance of the pattern has emerged; the immense popularity of standardized, computer-scored tests (e.g., SAT or GRE examinations) underscores the pervasive character of the cultural change implicit in Bentham's rejection of the punitive in favor of the reforming prison.

Beginning in the 19th century, written and numerically scored tests began to be favored over the "performance" test. Performance evaluations (e.g., medieval disputations, apprenticeships, oral examinations generally) require interaction between judge and judged; their interactive structure presumes that those on both sides of the evaluative divide share a common humanity. I pass a performance test when some judge (or judges) include me, by approving my performance, within the community which they have been authorized to represent. The inherent subjectivity of such performance testing--seed bed over centuries of various abuses such as old-boy networks and racist double standards--is moderated somewhat by the fact that I can physically touch and interact with those who claim the authority to judge me. Numerically scored tests, in particular when they took the true-false or multiple choice form early in this century, radically erode the communality and sensuality of the relationship. When I pass or fail a selection test I neither see or meet, nor can I influence, my judges. Like the invisible scrutinizer in Bentham's tower, those who wrote the standardized questions, among whose pre-designed responses I select, remain anonymous.¹⁸

This paper's brevity does not allow a full exploration of the bi-polar roles created by the Panopticon. It remains important, however, to at least sketch out some of places where it appears in the 19th and 20th centuries lest we underestimate its extraordinary hold on Western consciousness. All of us, when in our roles as ordinary citizens, find ourselves alternating between the role of the invisible watcher at the center of power and the marginalized and isolated object in

the peripheral cell. Besides our experience as participants in pre-designed, standardized tests noted above, we might consider a handful of examples where the same pattern is manifest in the United States.

Etiquette, the Theatre and Electronic Media: From Interactive to Passive Audience:

Beginning about 1830, etiquette books began their remarkable rise to popularity in the United States. They taught those aspiring to the middle class how to avoid misbehaving in public, a skill that Ervin Goffman and John Kassin call 'impression management.' The manuals taught, for example, nose decorum. You don't blow your nose in public if at all possible; you don't fondle your nose, and you certainly don't pick your nose and wipe your hand on your trousers. The books proscribed staring, shouting, singing, or humming out loud. Civilized adults kept unruly passions--sexual feelings, anger, even grief and joy--locked inside. One neither wept nor exulted in the streets.¹⁹

Earlier village life--for all its gossip and the long, sometimes unforgiving, memories that such an enclosed society fostered--rooted public identity in storytelling. People were known, not on the basis of the moment's immediate behavior, but rather according to cumulative stories that recalled a life-time of events. Impression management, on the other hand, rests on the assumption that I walk the city as a stranger subject to the scrutiny of other strangers. Thus etiquette literature redistributes the Panopticon roles. The anonymous scrutinizers have left the central tower and inhabit the streets of the city around me. From one angle, I am the marginalized and isolated outsider who is anonymously judged. From another, I manage my exterior impressions from the invisible tower of my hidden inner self.

A dramatic change in acceptable public behavior after 1840 widens the gap between watcher and watched in the context of public performance. Imagine, for example, going to the music hall or theatre about 1840 in New York. Audiences, raucous throngs that included all social classes in the same building, routinely interrupted the musicians by cheering, shouting and pounding the floor with their feet and sometimes demanding repetition of an especially-liked passage of the

music. Patrons booed, hissed, and threw rotten fruit or eggs at the play's villain. Lawrence W. Levine offers the following description of audience reaction when a visiting Italian opera troupe cut the final scene of an 1837 performance of Rossini's Semiramide without prior announcement. The New Orleans Picayune described the outcome of management's attempt to stop the wild uproar by darkening the hall and driving the audience out.

"t'was the signal for the demolition of everything they could lay their hands on. . . . The drapery around the boxes was torn, the cushions in the pit ripped open, the seats broken, and chairs were flying in all directions."

The next night, the chastened company performed "the last note that ever Rossini composed."²⁰ Audience-performer interaction was the norm and public performance sometimes approached the chaotic.

After the Civil War, however, a new discipline began to take hold. Thus, noted conductor Theodore Thomas insisted on silent audiences, sometimes turning to stare them into submission before continuing the performance. He and others like him conducted stern lessons in conformity and passivity. This increasingly powerful movement of audience reform reverses the polarities of Bentham's prison. The watched hold the position of power at center stage. Losing the power to interact, the audience is marginalized in the act of watching.²¹

The new style of audience conformity started to take hold just as electronic media began to revolutionize the very structure of public discourse. Before Samuel Morse's invention of a telegraphic code, and for the most part before the organization of the national wire service about 1870, information rarely traveled faster than a horse could trot. "The news" reported on a minuscule universe, one's village and a surrounding countryside perhaps thirty miles across. Messages from beyond horse-range arrived long after things happened and their rhetorical form differed accordingly. Pre-electronic newspapers published "correspondences," leisurely essays for readers who needed subtle details to understand the gradual unfolding of far away events. On the local scene, however, news-writers and news-readers shared the same living space. Thus, the

reader could ordinarily supply a host of nuances that the printed account only suggested and disagreements about interpretation could be settled right in town. Like the boisterous theater and music hall audiences, newspaper readers could actively intervene in public discourse.

Beginning about 1870 national telegraphic wire services began to change all that.²² In 1876, for example, if I lived in Chicago I would probably have read in the morning paper about the "Molly Maguire" trials hundreds of miles away in the eastern Pennsylvania coal region. I would learn that "the Mollies" were anarchistic Irish miners conspiring to violently destroy the lives and property of coal mine owners. I would have read, the morning after it happened, that twenty four were convicted and ten hung. I would not have known, however, that most historians have since come to interpret the trial as a frame-up and that the key witness was a Pinkerton detective in the employ of the owners.²³ The wire service news crafters did not choose to include that perspective and I, at my Chicago breakfast table, lived too far off to know more than the wire service told me. Live radio news beginning in the 1920s and more recent television coverage took instantaneous news one step farther. Instead of reading about news one day late, the audience could now 'participate' in events as they happened. Despite this dramatic intensification of audience involvement, however, the listeners or viewers gained not one whit of active power to shape public discourse.

A recent exception demonstrates the rule. During the Reagan-Bush administrations, while the New York Times and other mainstream media accepted the administration interpretation of Central America (e.g., struggling democracies in Salvador and Guatemala vs vile dictatorship in Nicaragua), a grass roots network communicated a distinctly different reading of events and significantly influenced national policy as a result. One has only to note, however, the enormous individual, group, and church efforts involved to recognize the untypical character of the example. Whether I favor or oppose the mainstream ideology is not at issue here. Whatever my ideology vis a vis the electronic media version at any given time, I typically relate to electronic discourse as a passive, isolated and powerless member of the audience, the very model of a Benthamite prisoner in reverse, frozen in the act of watching. Even when I shout at the tv because of a particularly odious ad or newscaster remark, nothing public or civic happens. It wears me out to try to imagine that I might change things.²⁴

Advertising and the Programmed Self:

Twentieth century advertising, the most important single offspring of mass media, demands special attention. The first three decades of this century saw a revolution in advertising style that originated in, reinforced, and eventually restructured the patterns we have been considering. Nineteenth-century advertisements tended to take the form of rational dialogue that assumed a basic equality between advertiser and reader. With the noteworthy exceptions of patent medicine, and P.T. Barnum-style fantastic entertainments, sales were thought to result from a description of product qualities or the simple announcement of available merchandise. By the early twentieth century, however, gradual changes in strategy began to coalesce in a new style. Just as Foucault's modern penal system shifted from assigning guilt and penalty for criminal acts to judging the inner soul of the criminal, so the new advertising turned away from the product to focus on the consumer and the benefits bestowed by the product. Emotion began to replace reasoned argument as the preferred rhetorical style; the targeted consumer was presumed to be irrational and inept. Advertising historian 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.²⁵

Consumerist advertisers go Bentham's invisible watchers one better; they search out the hidden motivations of "the consumer" to program them into conformity with the requirements of some unannounced economic interest. Insofar as consumerist advertising succeeds, itself a matter of considerable debate, I become a marginalized outsider to my own inner self.²⁶ The intent of the advertiser's shift from rational inter-subjective dialogue and announcement toward emotional manipulation is precisely to disconnect the consumer from his or her subjectivity; the inner self--with its tangle of integrity, passion, violence, and nobility--remains inaccessible even as it is manipulated by the advertisements.

II. Ford's Rouge: Standardization within a Guarded Perimeter:

He said we would have to have a model [of the proposed Ford Museum building] made, so we had a model made and it showed the balconies, naturally, and the basement, and he said, "What is this up here?" I said, "That is a balcony for exhibit. He said, "I wouldn't have that; there would be people up there, I could come in and they wouldn't be working. I wouldn't have it." He said, "I have to see everybody." Then he said, "What's this?" I said, "That is the basement down there, which is necessary to maintain these exhibits and to keep things which you want to rotate, etc." He said, "I wouldn't have that; I couldn't see those men down there when I came in. You have to do the whole thing over again and put it on one floor with no balconies and no basements." I said, "Okay."²⁷

Across the Atlantic and more than a century after Bentham, a second factory design came to be seen as an icon of the spirit of modernity. This factory, however, acquired the capital investment and physical reality that eluded Bentham. Within a few years of its completion in 1923, the Ford Motor Company's massive River Rouge plant achieved mythic stature and world acclaim as the ultimate expression of "Fordismus," the triumph of rational efficiency over nature and the burdens of life. Tourists from around the world, by the hundreds of thousands made pilgrimage to the Rouge in the late Twenties. German engineer, Otto Moog was not unusual when he recorded his impressions in language that combines an almost schizoid mixture of quasi-religious intimidation and awe with an exultant sense of liberation.

"No symphony, no Eroica, compares in depth, content, and power to the music that threatened and hammered away at us as we wandered through Ford's workplaces, wanderers overwhelmed by a daring expression of the human spirit."²⁸

Solipcism and Power: Ford's Obsession with Control:

When construction began along the banks of the Rouge River in 1915, "Henry Ford" was already a household word. More than half the autos in the United States were Model T's, arguably the most successful match between a single technical design and its societal context in recorded history. For well over a decade, Ford sold the ugly, durable vehicles as fast as they could be manufactured. Ford had already begun to capture world attention when, in 1914, his simultaneous completion of the moving assembly line and doubling of wages ("The Five Dollar Day") stunned competitors and intensified his image as industrial genius and workingman's friend.

Less visible was his fixation on control. Workers, for example, became eligible for the \$5 Dollar Day labor reform package only when they submitted to and passed inspection about intimate details of their personal lives. Members of the newly created Sociological Department checked cleanliness, debt, drinking habits, etc. A failing grade meant that the profit sharing bonus was put in escrow until the worker mended his ways. Failure to comply eventually meant firing.²⁹ Seeking to escape dependence on outside suppliers, Ford used the Rouge river's access to the Great Lakes and adjacent intersecting rail lines to create the logistical heart of a mine-mouth-to-dealership empire. He purchased mines and forests, a rubber plantation in Brazil, a rail line and a Great Lakes shipping line so that by the mid 1920's Ford boats and trains carried Ford iron ore, hardwood and other inputs to the largest industrial plant the world had ever seen.

Ironically, while the Rouge appeared to the world as the symbolic capstone of Ford's world-class technological triumph, the design concepts on which it was based reveal unmistakable signs of Ford's retreat into a solipsistic world that excluded of those whose independent thinking threatened him. Thus, in 1919, after major stockholders sued (and won) because of Ford's practice of diverting potential dividends back into company expansion, Ford conducted an elaborate and deceptive strategy for buying them out. Almost simultaneously, three of "his ablest lieutenants" (C. Harold Wills, John R. Lee, Norval Hawkins) resigned under pressure.³⁰

During the twenties, Ford's reclusive tendencies deepened. Fairlane, the Ford mansion completed in 1916, stood on the banks of the Rouge river in Dearborn miles from most of Detroit's elite society who lived across town along Grosse Pointe's mansion row. After his national humiliation during the 1919 Chicago Tribune trial, he withdrew more and more into the company which he now totally controlled and, as the decade continued, to his personal playground, the Henry Ford Museum and Greenfield Village. For some years after it became operational, the Museum and the Village were not open to the public. The complex served as a small trade-based boarding school. Private groups and individuals were sometimes permitted to visit the collections but no policy of public admission was implemented until June 22, 1933.³¹

One of the Rouge's design departures from its predecessor at Highland Park would later become a world famous symbol of Ford's rejection of debate and dissent. Just as Ford pursued integrated control of inputs through his network of transportation lines converging on the Rouge, so he sought even more control over workers than the house-to-house inspections and in-factory spy networks of the 1914 labor reforms provided. The earlier Highland Park plant opened directly onto Woodward Avenue, leaving Ford management with no say about who mingled with workers on the public streets fronting the factory. Plant accessibility meant unwanted interference. In dramatic contrast, the new Rouge compound was insulated by a fully fenced perimeter and tightly guarded gates. The Miller Road Gate # 4 became world infamous when photographers caught Ford thugs beating UAW activists Walter Reuther and Richard Frankenstein in 1937's "battle of the overpass." Independent minded workers seeking to organize a union were anathema to Ford; they apotheosized the intrusion of pluralism into the ideologically standardized interior of the Ford universe.

Ford's Aesthetic: The Clean Machine

Ford's aversion to independent thinking is echoed in his habits of displaying industrial technology. His great love affair with technological symbols during the twenties--the multi million dollar Henry Ford Museum and *Greenfield Village*--revealed a powerful strain of romantic nostalgia and an equally powerful commitment to contemporary technocratic motifs. *Greenfield Village* ignored twentieth century technologies almost completely and, indeed, made expensive hash of any historical chronology. Ford bought what he liked and installed it. Shrines to American heroes dotted the landscape: Abraham Lincoln's early court house, homes of Noah Webster, Ford himself, and the Wright brothers, and the jewel of the collection, a worshipful reincarnation of the laboratory complex at Menlo Park where Thomas Edison had invented the electric light a half century before.³²

The adjacent Ford museum aimed more at aesthetically pleasing arrays of artifacts, (most notably: steam engines, automobiles, locomotives, agricultural equipment, machine tools, and domestic appliances) each series arranged in chronologically ascending order to demonstrate the

march of inventive progress. In both places, however, as well as in almost every other part of his domain, Ford went to considerable lengths to display large scale machines as sensuous, almost numinous, icons. In the Village, he ordered the walls opening into the steam engine rooms of the Loring gristmill and adjacent Armington and Sims machine shop changed from the original wood to glass so that he could watch the machines work as he drove by. The powerhouse at the Highland Park plant was deliberately displayed to Woodward Avenue passersby through walls of showroom glass; inside, the dynamos were enthroned amid gleaming brass and tile and not a few observers of Ford's secluded "Fairlane" estate have noted that its only really elegant building was the hydro-power plant, that displayed its dynamos in similar fashion.³³

Ford's industrial aesthetic, so like the design of the Rouge plant in its avoidance of the messy political side of technology, can be understood as the eccentric aberrations of a man whose rise to fame and fortune permitted him to indulge in a growing obsession with privacy and personal control.

From another perspective, however, Ford's ambivalent mix of liberation and repression, so aptly captured by Otto Moog and similarly articulate visitors to the Rouge, fits quite closely other idealizations of progress in the twenties and thirties. Perhaps the most striking symbolic representation of popular ambivalence about technological triumphs would appear in the main foyer of the Hall of Science at the 1934 Chicago "Century of Progress" Exposition, itself an astonishing romanticization of science and technology during the depth of the Depression. Visitors to the Fair's 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-sized figures, male and female, faced forward with arms uplifted. Both were dwarfed by the massive figure of a metallic 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." The sculpture's iconographic ideology was reinforced by the official Guidebook's stunning, bold-faced thematic motto: "SCIENCE FINDS, INDUSTRY APPLIES, MAN CONFORMS."³⁴

The Chicago Fair's technocratic ideal is rooted in a violent disjunction between the combined force of "Science" and "Industry" (itself a conflation of business and technology) on the one side and "Man" on the other. The role of "Man" in the modernist equation is not to "Critique" fallible decisions made by scientists, business managers or engineers; it is not even to "Use" the new technologies. The Role of "Man" is to "Conform."³⁵

III: System vs Sensuality: Science & Technology as Cultural Forms

All these stories abound with instances of the same paradox: Ford's Model T provides geographical mobility for an entire generation of people with modest means, giving them access to sophisticated transportation technology, both cheap and easy to repair. Meanwhile the much more sophisticated system that produces them encloses Ford workers in prison factories hedged about with enforcers and impermeable fences. Bentham's Panopticon would free the criminal from torture and dungeon but offers re-instatement into society at the terrible cost of programmed conformity to a mythic, omnipresent, and invisible scrutinizer. Twentieth century citizens break free from the suffocation of minuscule village perspectives through the mediation of global and instantaneous electronic media. At the same time their capacity for active participation in public discourse and the political order erodes.

It is a telling irony, one that reveals a great deal of the strengths and liabilities of Western-style modernity, that both scientific and technological practice themselves often mirror Bentham's tower and Ford's policed perimeter. Panopticonism and Fordism work to interdict negotiation about system design and operation between scrutinizer and prisoner, management and labor, the governing elite and the governed, in short, they shield experts from the intervention of non-elites. In precisely the same way, the scientific method's controlled variable environment with its canon of replicability excludes non-experts from the workings of the method. Science has its own aesthetic, a sanitized place cleansed of the untrustworthy presences of bias, vested interest, emotion or tradition. The controlled variable experiment, therefore, constitutes a revolutionary

new form of cultural space: an inaccessible interiority cuts off the working of the experts' method from the turbulence of outside society.

This protected environment has, as we have seen, developed into a multi-form and pervasive cultural force. Its most important influence may well be the radically increased social distance between decision centers, where options are debated, taken, and eventually legitimated, and the periphery, where non-decision-makers endure the results of the hidden process. That societal chasm is filled by a constructed mechanism, sometimes called "the system," which demands conformity as a take-it-or-leave-it price for participation. Sometimes the distance between margin and center can be maintained with a smiling face, as with the entertaining demeanor of television personalities, or with no face at all, as in anonymous standardized tests. At other times, as in Ford's closely guarded Rouge plant, the distance can only be maintained by brute physical force. In all cases, the primary benefit acquired by distancing the decision center from intruders remains the same. Some insider elite, scientific, technological, economic or political, is given the space within which to pursue the detailed and arduous tasks of system design.³⁶

Of course, the act of designing requires a protected space. At some point debate must stop and decisions crystalized if the creative process is to come to term. Nevertheless, protected design space is a mixed blessing in the strict sense of the term "mixed" and it is the business of this paper to call attention to what is gained and lost by the social legitimacy that has accrued to it in the past two centuries.

The Good News: Western science and technology have converged as powerful influences to foster an increasingly global consciousness that transcends the limitations resident in any local scene. Scientific communities, for example, have developed a cosmopolitan tradition of multi-lingual cooperation, in part due to their insistence that valid conclusions must be open to replication by peers who live somewhere else. Transportation systems (air, overland, and water) have achieved such high levels of reliability and speed that they now constitute an interlocking network for moving people and freight virtually anywhere in the world. Electronic media, of course, move information--

text, sound, and image--more rapidly still so that the entire set of network technologies work in concert to break human transactions free from local constraints.³⁷

By their commitment to rationality and speed, and consequent alignment against the local, the anecdotal, and the sensual, Western science and technology tend to dampen the periodic swings toward fanaticism which flourish in the humid soil of enclosed, sensual and cultic societies. It is an achievement of great importance. James Jone's "Jonestown" has come to serve as a tragic icon in this regard. That half a thousand people could be induced to commit communal suicide surely had something to do with their jungle isolation. Outsiders had no opportunity to critique those in the commune and shake them from their mesmerized fanaticism. What was lacking, in scientific terms, was the application of the canon of replicability. Outside observers should have been given voice to contest the claims of James Jones.

The Bad News: Dis-empowering the local and indigenous, however, can be powerfully seductive for elite design constituencies. Note that the patterns of culture so briefly sketched above reveal a cultural context wherein small elite power centers pair off against large arrays of marginalized conformers. Whether in the Bentham panopticon, the increasingly class-divided theatres, the twentieth century electronic media audiences, or a Ford factory, these systems of cognition and discourse all insure what Bentham intuitively insisted on: that those on the margin not be able to see or actively influence those at the command central tower.

This tends to play itself out in Science with contempt for local traditions of wisdom, whether pre-Western or non-Western, with the conviction that non-experts have nothing to teach the design elite in question. Managers of technological systems, for their part, frequently invest in designs aimed at preventing workers and "the public" from having access to managerial decision making processes. In other words, elitist control sometimes masquerades as a technical requirement when it merely enforces a hankering for working space that has been cleared of outsider critique.³⁸

So we come to the question; do science and technology as ordinarily practiced constitute a liberating force or an imprisoning one? Insofar as scientific and technical elites find ways to render their value-laden judgments about priorities accessible to outside critique and pluralistic

debate, their work will flourish as an essentially beneficent influence within society at large. Insofar, on the other hand, as such elites succumb to the seduction of the Bentham Tower and the Ford Fence, they ironically replicate the very evils they claim to overcome. Inside the tower and behind the fence experts easily succumb to the fleshy temptations inherent in any enclosed local environment--old boy networks and the blind biases of unchallenged assumptions. The structure of the protecting claim to dispassionate and value-free objectivity and the rejection of human pluralism implied therein can easily mask the question of power.³⁹

To summarize in necessarily over simple terms: the policing of the method, once the value of its project has been agreed on, needs to be the business of the elite insiders, but the negotiation and debate that establishes the value of one design over another must include non-elite outsiders.

This is very hard work and I do not intend to minimize its difficulty. Indeed, the primary purpose of this paper is to call attention to the cultural patterns which render it so difficult for Westerners to find the patience and the nerve to engage in tough debates about scientific and technical priorities, about the allocation of the increasingly scarce resources available to our societies, and about the determination of the questions: "Who wins, who loses, and how much does it matter?" The cultural trends toward a Benthamized public conformity--where individuals shrink from the responsibilities of adult citizenship in the public arena--run deep. They are embedded in our affectivity and our self-understanding and they shape our expectations about how much can be hoped for from the public order. Citizens of Western societies must reopen Bentham's tower and break through Ford's fences so that we can risk a rebirth of the turbulent and unpredictable forms of genuine civil discourse as the millennium in which Western culture achieved global power draws to a close. Lacking the courage to do so would very likely insure that the next millennium will not treat the West so kindly as the last.

Endnotes

¹ For the full argument see my Technology's Storytellers: Reweaving the Human Fabric, (Cambridge: The MIT Press, 1985), Chapter 3.

² Edwin Layton's "Mirror Image Twins: The Communities of Science and Technology in 19th Century America" (Technology and Culture 12,4 (October 1971):562-80) still stands as one of the most insightful articulations of the difference between scientific and technological communities. Thus: "In the physical sciences the highest prestige went to the most abstract and general--that is to the mathematical theorists from Newton to Einstein. Instrumentation and applications generally ranked lowest. In the technological community the successful designer or builder ranked highest, and the "mere" theorist the lowest." p. 577.

See also Walter G. Vincenti, What Engineers Know and How They Know It: Analytical Studies from Aeronautical History (Baltimore: The Johns Hopkins Press, 1990).

³ David S. Landes, The Unbound Prometheus. Landes caricatures all cognition that does not take a means-to-ends form as "superstition and magic," p. 21. See the following pages for further examples of Landes' disjunction between rationality and all other modes of consciousness which are defined as defective by Landes' dismissive, and occasionally derisive, tone.

The most articulate critique of this definition of rationality that I have yet encountered is by Renato Rosaldo, Culture and Truth: The Remaking of Social Analysis (Boston: Beacon Press, 1989). Thus, for example, "The point is to break objectivism's monopoly on truth claims, not to throw out the baby with the bath water. . . . When the workings of culture are reduced to those of a control mechanism, such phenomena as passions, spontaneous fun, and improvised activities tend to drop out of sight."(p. 102) or "In my view, optionality, variability, and unpredictability produce positive qualities of social being rather than negative zones of analytically empty randomness." (p. 112) but see also the full extent of his argument throughout Part One.

⁴ See, for some recent discussions of contextualism, Robert C. Post and Steven H. Cutcliffe, eds. In Context: History and the History of Technology, Essays in Honor of Melvin Kranzberg, (Bethlehem, PA: Lehigh University Press, 1989): 150-171.

⁵ Scholars representing a broad range of interpretative perspectives have come to agree on the importance of contextual factors for interpreting science. See, for example, Arnold Thackray, "History of Science," in Paul Durbin, ed., A Guide to the Culture of Science, Technology, Medicine, (New York: Free Press 1979); Evelyn Fox Keller, Reflections on Gender and Science, (New Haven, CT: Yale University Press, 1985); Bruno Latour, Science in Action: How to Follow Scientists and Engineers through Society (Milton Keynes, Bucks.: Open University Press: Cambridge MA: Harvard University Press, 1987) and Steven Toulmin, Cosmopolis (New York: MacMillan, 1990).

⁶ The concept of professionalism, that empowers the licensed practitioner while delegitimizing outsiders is a central achievement in 19th century Western society. See, for example, Burton J. Bledstein, The Culture of Professionalism: The Middle Class and the Development of Higher Education in America, esp. Ch. 3.

⁷ My thinking here originates with the study of technological style in the United States. Thus my application of these insights to European technological practice and to scientific practice generally represents something of a reach.

⁸ Jeremy Bentham, "Panopticon; or, The Inspection House," in The Works of Jeremy Bentham, (published under the superintendence of his executor, John Bowring) Vol. 4 (New York: Russell and Russell, 1962), page 39.

⁹ I am indebted, for this turn of phrase, to Shoshanah Zuboff, In the Age of the Smart Machine: The Future of Work and Power, (New York: Basic Books, 1988) p. 320.

¹⁰ Bentham articulated four defining principles:

- (1) Cells "divided from one another . . . secluded from all communication with each other, by partitions";
- (2) "Each cell has in the outward circumference a window, large enough, not only to light the cell, but, through the cell, to afford light enough to the correspondent part of the [inspector's] lodge. The inner circumference of the cell is formed by an iron grating, so light as not to screen any part of the cell from the inspector's view";
- (3) "To prevent thorough light, whereby . . . the prisoners would see from the cells whether or no any person was in the lodge, that apartment is divided into quarters, by partitions";
- (4) "Small lamps, in the outside of each window of the lodge, backed by a reflector, to throw the light into the corresponding cells, would extend to the night the security of the day." "Panopticon" p. 40.

¹¹ Works of Jeremy Bentham Vol. 10 p. 226. Cited in Carolyn C. Cooper, "The Portsmouth System of Manufacture," Technology and Culture 25,2 (April 1984):193.

¹² Bentham, "Panopticon," p. 40 (author's emphasis).

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- ¹³ Discipline and Punish: The Birth of the Prison, trs. Alan Sheridan, (New York: Random House, Vintage Books, 1979) pp. 201-202.
- ¹⁴ Jean Hampton discusses reconciliation joined to capital punishment. See her "The Retributive Idea," in Jeffrie G. Murphy and Jean Hampton, Forgiveness and Mercy (New York: Cambridge University Press, 1988) p. 158.
- ¹⁵ Ibid. p. 19. Emphases mine.
- ¹⁶ "Therapy, Not Punishment," Harpers Magazine (August 1959):63-64 (emphases mine). Menninger is quoted, together with Bertrand Russell, B. F. Skinner, and Benjamin Karpman to much the same effect, in Herbert Morris, "Persons and Punishment," The Monist 52 (October 1968): 480-81. Morris' essay has acquired the status of a classic critique of the therapeutic replacement of punishment. He roots his argument in the inherent dehumanization of the person when guilt is replaced by treatment. "In this [therapeutic] world we are now to imagine when an individual harms another his conduct is to be regarded as a symptom of some pathological condition in the way a running nose is a symptom of a cold." p. 480.
- ¹⁷ Harley Shaiken, Automation and Work in the Computer Age (New York: Holt, Reinhart and Winston, 1983). Shoshanah Zuboff, In the Age of the Smart Machine, passim.
- ¹⁸ See George F. Madaus, "Curriculum Evaluation and Assessment," in Handbook of Research on Curriculum, P. Jackson ed. (New York: MacMillan, forthcoming). See also Zuboff (especially cc. 6-7, 9-10) for discussion of the use of computerized algorithms in decision-making roles as precisely the same process of distancing the evaluated from the point at which the evaluative judgment is rendered.
- ¹⁹ Erving Goffman, Asylums: Essays on the Social Situation of Mental Patients and Other Inmates, (Garden City, NY, 1961). John F. Kasson, Rudeness and Civility: Manners in Nineteenth Century America (New York: Hill and Wang, 1990). See Chapter 1 for his estimate that an average of three new etiquette books annually before the Civil War and rose to an average of five or six per year from 1870 through World War I. See Chapters 4 and 5 on body control advice.
- ²⁰ See Lawrence W. Levine, Highbrow Lowbrow: The Emergence of Cultural Hierarchy in America (Cambridge: Harvard University Press, 1988) p. 91.
- ²¹ See Levine, Highbrow-Lowbrow, passim and Kasson, Rudeness and Civility, Chapter 7. Levine notes that the gradual disciplining of audience interaction was accompanied by the creation of separate establishments for upper class and lower class patrons.

²² On the early history of the wire news services see Daniel J. Czitrom, Media and the American Mind: From Morse to McLuhan (Chapel Hill, 1982) especially Chapter 1; Richard Schwarzlose, "Harbor News Association: The Formal Origins of the AP," Journalism Quarterly 45 (Summer 1968):253-60; Robert Luther Thompson, Wiring a Continent: The History of the Telegraph Industry in the United States, 1832-1866 (Princeton: Princeton University Press, 1947) and Richard B. DuBoff, "Business Demand and the Development of the Telegraph in the United States, 1844-1860," Business History Review 54 (Winter 1980):459-79 and "The Telegraph and the Structure of Markets in the United States, 1845-1890," Research in Economic History 8 (1983):253-77.

²³ The Molly trial was probably the first "national media" event in U.S. labor history. Joseph Rayback describes the immediate and longterm effects of the trial as follows. "The evidence against them, supplied by James McParlan, a Pinkerton [detective], and corroborated by men who were granted immunity for their own crimes, was tortuous and contradictory, but the net effect was damning. All twenty-four were convicted; ten were executed. The trial temporarily destroyed the last vestiges of labor unionism in the anthracite area. More important, it gave the public the impression that miners in general were inclined to riot, sabotage, arson, pillage, assault, robbery, and murder; and that miners were by nature criminal in character and were to be condemned and disciplined by the more respectable element in society. The impression became the foundation for the antilabor attitude held by a large portion of the nation to the present day." A History of American Labor (New York: MacMillan, Free Press 1966) p. 133.

²⁴ In his recent critical assessment of Richard Rorty, Christopher Norris uses U.S. media coverage of the Iraq war to exemplify some of the philosophical and pragmatic problems that reside in electronically mediated public discourse. ("The 'End of Ideology' Revisited: The Gulf War, Postmodernism and Realpolitic," Philosophy and Social Criticism 17, 1 (November 1991):1-40.

²⁵ Roland Marchand, Advertising the American Dream: Making Way for Modernity, 1920-1940, [Berkeley: University of California Press 1985], pp. 68-69 and passim. See also Daniel Pope, The Making of Modern Advertising, (New York: Basic Books, 1983), Leiss, Kline and Jhally, Social Communication in Advertising, and T. J. Jackson Lears, "From Salvation to Self-Realization: Advertising and the Therapeutic Roots of the Consumer Culture, 1880-1930," in The Culture of Consumption: Critical Essays in American History, 1880-1980, Richard Wightman Fox and T.J. Jackson Lears, eds., (New York: Pantheon Books, 1983):1-38. I am also deeply indebted to many conversations with Pamela Walker Lurito for my understanding of changing advertising trends.

²⁶ Debates about the effectiveness of advertisements in programming consumer motivation are commonplace in recent studies. Michael Schudson (Advertising, the Uneasy Persuasion: Its Dubious Impact on American Society, [New York: Basic Books, 1984]) argues the case against it. Leiss, Kline, and Jhally, (Social Communication in Advertising, CC. 2, 3) discuss the pros and cons of both sides, citing Schudson, Stuart Ewen, Christopher Lasch, and others; their own position tends to favor Schudson's.

²⁷ (Robert O. Derrick, architect hired to design the Henry Ford Museum, Oral Reminiscences) p. 50 [emphases mine]. Geoffrey C. Upward, A Home for Our Heritage: The Building and Growth of Greenfield Village and Henry Ford Museum, 1929-1979 (Dearborn: The Henry Ford Museum Press, 1979) p. 50

²⁸ (Otto Moog, German Engineer, in Thomas P. Hughes, American Genesis, p. 291, authors translation of Otto Moog, Druben steht Amrika: Gedanken nach einer Ingenieurreise durch die Vereinigten Staaten (Braunschweig: G. Westermann, 1927) p. 72. Hughes cites another German engineer, Franze Westermann, saying "the most powerful and memorable experience of my life came from the visit to the Ford plants . . ." p. 99

²⁹ See Stephen Meyer, The Five Dollar Day, (Albany, State University of New York Press, Albany, 1981) especially cc. 5-8.

³⁰ On the stockholder buyout see Alan Nevins and Frank Ernest Hill, Ford: Expansion and Challenge: 1915-1933, (New York: Charles Scribner's Sons), pp. 105-11.

Nevins interprets the three resignations as follows: "Ford . . . looked aback with distaste on the period of Couzen's activity in company affairs, when he had been unable to move freely. The Dodge suit had of course intensified his desire for absolute authority. He was therefore irritated by the presence of anyone in the company who might not work with him in complete harmony." (Ibid, p. 145).

³¹ See A Home for Our Heritage: The Building and Growth of Greenfield Village and Henry Ford Museum, 1929-1979, Geoffrey C. Upward, museum editor, (Dearborn, MI: The Henry Ford Museum Press, 1979), p. 76.

In 1919, Ford sued the Chicago Tribune for libel, was grilled on the stand with lines of questions demonstrating his flimsy educational background, and was awarded six cents in damages. Robert Lacey, Ford: The Men and the Machine, (Boston: Little, Brown and Co. 1986) pp. 197-202.

³² Greenfield Village was officially opened on October 21, 1929 when the aging Edison, flanked by Ford and President Hoover re-enacted the invention by turning on a replica light bulb. The "Festival of Light" was transmitted over a national radio network, one of the first "live" media events in history. The only published account that treats the event in any detail is Upward, Home for Our Heritage, chapter 3.

33 Lacey, for example: ". . . there was only one beautiful room in the entire building: the powerhouse. This was a spare, clean chamber which Henry had designed himself . . . and he created a very Ritz of power stations, all marble and gleaming brass dials and pipes. Around the floor were set out little generators, raised on plinths like so many modern sculptures . . ." pp. 149-50. See also, Collier and Horowitz, p. 71. See also Nevins, pp. 20-21.

The clean, uncluttered, "Ford" style that Charles Sheeler would make famous with his late twenties photographs and paintings may represent the continuation of, and not a completely fresh artistic reflection on, the Ford style. See Mary Jane Jacob, "The Rouge in 1927: Photographs and Paintings by Charles Sheeler," in The Rouge: The Image of Industry in the Art of Charles Sheeler and Diego Rivera (funded by the Ford Motor Company Fund and Founders Society Detroit Institute of Arts) and, more recently, Karen Lucic, Charles Sheeler and the Cult of the Machine (Cambridge, Harvard University Press 1991).

34 Chicago Century of Progress International Exposition, Official Book of the Fair, (Chicago: A Century of Progress, Inc., 1932), p. 11. 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 of the Henry Ford Museum and Greenfield Village, for copies of the Official Book and photos of the iconography referred to here.

For the Lohr quote see, Fair Management: The Story of a Century of Progress Exposition, (Chicago: The Cuneo Press, Inc., 1952), p. 96.

35 Popular feelings about technocratic elitism was clearly mixed. Industrial unions flourished in the Thirties as workers organized to contest managerial high-handedness. On the other hand, even so shocking an episode as 1937's battle of the overpass evoked an outpouring of fervent support for Ford's dictatorial labor style in hundreds of handwritten letters from ordinary citizens around the country. (Archives and Library Department, Henry Ford Museum & Greenfield Village, Dearborn MI, Acc. 292 Box 43.) My cursory inspection suggests that the vast majority of the letters, although not all, strongly favor Ford's position.

36 Recently several sociologists of technology have developed the concept of "negotiation spaces" to address much the same point. Thus: "... we have shown how the proponents of the project mobilized the actors in a global network and sought to create a relatively autonomous negotiation space where a local sociotechnical network might be designed and brought into being without constant interference from outside." John Law and Michel Callon, "Engineering and Sociology in a Military Aircraft Project: A Network Analysis of Technological Change," Social Problems Vol. 35, No. 3 (June 1988): 290.

37 Steven Toulmin argues that it is precisely this systematic rejection of the cognitive validity of the local, the oral, the specific, and the timely in favor of the universal, the written, and the timeless, that characterizes what came to be the central orthodoxy of "modernity." For his argument that aversion to the specific and local stems from Europe's loss of nerve (and sense of humour) in the face of the Thirty Year's War with its carnage of competing religious orthodoxies, see Cosmopolis, chapters 1 and 2. The passage about the local, oral, specific, etc. begins on page. 32.

David Harvey's interpretation of changing capitalist social definitions of space and time and their influence on contemporary society is the most helpful and sophisticated that I have read. See his The Condition of Postmodernity (Cambridge, MA: Basil Blackwell, 1989) especially Part III.

38 Shoshanah Zuboff records repeated instances where managers react "irrationally" to the democratizing influences of open-access computer data bases despite the evidence that such open access, a process for which she coined the name "informating," increased efficiency and profitability, managers experienced disorientation and fear when their control over subordinates was threatened. See, In the Age of the Smart Machine, passim.

39 Peter Sandman has developed a persuasive model explaining the increasing social cost that comes due when non-elites are excluded from such prioritizing debates. See his "Hazard versus Outrage in the Public Perception of Risk," in Vincent T. Covello, David B. McCallum, and Maria T. Pavlova (eds.) Effective Risk Communication (New York: Plenum, 1989):45-49. on the importance of inclusion of non-elites within such prioritizing debates. See also Parker Palmer (The Company of Strangers: Christians and the Renewal of America's Public Life, [New York: Crossroads, 1985]) for a complementary societal analysis.