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# CRITICAL THEORY OF TECHNOLOGY

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# PREFACE

Must human beings submit to the harsh logic of machinery, or can technology be fundamentally redesigned to better serve its creators? This is the ultimate question on which the future of industrial civilization depends. It is not primarily a technical question but concerns a fundamental issue in social philosophy, the neutrality of technology and the related theory of technological determinism. If technology is neutral, then its immense and often disturbing social and environmental impacts are accidental side effects of progress. Much current debate polarizes around the question of whether these side effects outweigh the benefits. The advocates of further progress claim "reason" as their ally while the adversaries defend "humanity" against machines and mechanistic social organizations. The stage is set for a struggle for and against technology.

*The Critical Theory of Technology* rejects this alternative and argues that the real issue is not technology or progress *per se* but the variety of possible technologies and paths of progress among which we must choose. Modern technology is no more neutral than medieval cathedrals or The Great Wall of China; it embodies the values of a particular industrial civilization and especially of its elites,which rest their claims to hegemony on technical mastery. We must articulate and judge these values in a cultural critique of technology. By so doing, we can begin to grasp the outlines of another possible industrial civilization based on other values. This project requires a different sort of thinking from the dominant technological rationality, a critical rationality capable of reflecting on the larger context of technology. I address these issues from several different angles in the chapters that follow.

The Introduction defines critical theory of technology and situates it in relation to other approaches to technology. Part I argues that for all its insight Marx's critique of industrialism lacks a plausible strategy of change. The historical experience of communism shows that states are not the primary agents of radical technological transformation, as Marx believed. The second Part addresses the alternative in a discussion of the relationship of human initiative to technical systems, both in general and specifically in the field of computers. Since modern hegemonies are increasingly organized around technology, this relationship has become central to the exercise of political power. Part III considers the larger cultural context of technological change. Too often technology and culture are reified and opposed to each other in arguments about the "trade-offs" between efficiency and substantive goals such as participation or environmental compatibility. A better understanding of the relation of technology and culture dissolves these apparent contradictions. The conclusion develops this argument further through a discussion of technology's democratic potentialities. These potentialities, suppressed today, may become the basis in the future for a society that reconciles wider freedoms with more meaningful forms of material well-being.

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# INTRODUCTION: THE PARLIAMENT OF THINGS

## Technology and the End of History

It is widely believed that technological society is condemned to authoritarian management, mindless work, and equally mindless consumption. Social critics claim that technical rationality and human values are contending for the soul of modern man. This book challenges such cliches by reconceptualizing the relation of technology, rationality, and democracy. My theme is the possibility of a truly radical reform of industrial society.

I argue that the degradation of labor, education, and the environment is rooted not in technology *per se* but in the anti-democratic values that govern technological development. Reforms that ignore this fact will fail, including such popular notions as a simplified lifestyle or spiritual renewal. Desirable as these goals may be, no fundamental progress can occur in a society that sacrifices millions of individuals to production.

A good society should enlarge the personal freedom of its members while enabling them to participate effectively in a widening range of public activities. At the highest level, public life involves choices about what it means to be human. Today these choices are increasingly mediated by technical decisions. What human beings are and will become is decided in the shape of our tools no less than in the action of statesmen and political movements. The design of technology is thus an ontological decision fraught with political consequences. The exclusion of the vast majority from participation in this decision is the underlying cause of many of our problems.

I will show that only a profound democratic transformation of industrial civilization can resolve these problems. Historically, such a transformation has been called "socialism," but ever since the Russian Revolution that term has described a particularly undemocratic version of our model of industrial civilization. The recent breakdown of these communist regimes and their Marxist orthodoxy creates an opportunity to revive interest in democratic socialist theory and politics. Yet this opportunity may be missed by many who, regardless of their evaluation of the Soviet regime, interpreted its stubborn resistance to capitalism as the chief symbol of an open-ended future. Today, as that resistance fades, the "post-modern" decade of the 1980s reaches a fitting climax in the "end" of history.

The end of history: the radical critique of modern societies is mere speculation; progressive development is a narrative myth; alienation is an outmoded literary conceit. Salvation is to be found in irony, not revolution; the fashionable politics, even on the left, is deregulation, not self-management.

This mood is shaped by the consensus which links much of the left with the establishment in celebration of technological advance. But technology has become so pervasive that the consensus leaves little of practical import to disagree about. The struggle over a few emotionally charged issues of human rights, such as abortion, disguises the hollowness of public debate, the lack of historical perspective and alternatives. There seems to be room only for marginal tinkering with an ever diminishing range of problems not inextricably bound up with technique. This outcome was anticipated more than a generation ago by Karl Mannheim:

It is possible, therefore, that in the future, in a world in which there is never anything new, in which all is finished and each moment is a repetition of the past, there can exist a condition in which thought will be utterly devoid of all ideological and utopian elements. But the complete elimination of reality-transcending elements from our world would...bring about a static state of affairs in which man himself becomes no more than a thing....Thus, after a long tortuous, but heroic development, just at the highest stage of awareness, when history is ceasing to be blind fate, and is becoming more and more man's own creation, with the relinquishment of utopias, man would lose his will to shape history and therewith his ability to understand it.[1]

In Mannheim's terms, the problem we confront today is how to sustain a faith in historical possibility without messianic hopes. Can a sober reflection on the future find anything more than a mirror of the present? I believe it can, and have done my best to awaken a sense of the choices that lie before us through an analysis of our disappointment with the largely fulfilled promise of technology. To this end I reopen the debate over socialism in confrontation with various technical and practical objections, and suggest a coherent alternative that would preserve and advance our

threatened democratic heritage.

That heritage is endangered today by the growing gap between the intellectual requirements of citizenship and work, and the frozen opposition of market and bureaucracy. Can we conceive an industrial society based on democratic participation in which individual freedom is not market freedom, and in which social responsibility is not exercised through coercive regulation? I will argue that a democratic politics of technology offers an alternative and overcomes the destructive relation of modern industrialism to nature, both in human beings and the environment.

# Instrumental and Substantive Theories of Technology

In the pages that follow I present this position as an alternative to several established theories of technology. These fall into two major types: *instrumental* theory, the dominant view of modern governments and the policy sciences on which they rely; and *substantive* theory, such as that of Jacques Ellul.[2] The former treats technology as subservient to values established in other social spheres, e.g. politics or culture, while the latter attributes an autonomous cultural force to technology overriding all traditional or competing values. Substantive theory claims that what the very employment of technology does to humanity and nature is more consequential than its ostensible goals. I will review these theories briefly before introducing a *critical theory of technology* which, I believe, preserves the best in both while opening the prospect of fundamental change.

*Instrumental Theory*

Instrumental theory offers the most widely accepted view of technology. It is based on the common sense idea that technologies are "tools" standing ready to serve the purposes of their users. Technology is deemed "neutral," without valuative content of its own. But what does the notion of the "neutrality" of technology actually mean? The concept usually implies at least four points:

1. Technology, as pure instrumentality, is indifferent to the variety of ends it can be employed to achieve. Thus, the neutrality of technology is merely a special case of the neutrality of instrumental means, which are only contingently related to the substantive values they serve. This conception of neutrality is familiar and self-evident.

2. Technology also appears to be indifferent with respect to politics, at least in the modern world, and especially with respect to capitalist and socialist societies. A hammer is a hammer, a steam turbine is a steam turbine, and such tools are useful in any social context. In this respect, technology appears to be quite different from traditional legal or religious institutions, which cannot be readily transferred to new social contexts because they are so intertwined with other aspects of the societies in which they originate. The transfer of technology, on the contrary, seems to be inhibited only by its cost.

3. The socio-political neutrality of technology is usually attributed to its "rational" character and the universality of the truth it embodies. Technology, in other words, is based on verifiable causal propositions. Insofar as such propositions are true, they are not socially and politically relative but, like scientific ideas, maintain their cognitive status in every conceivable social context. Hence, what works in one society can be expected to work just as well in another.

4. The universality of technology also means that the same standards of measurement can be applied in different settings. Thus technology is routinely said to increase the productivity of labor

in different countries, different eras and different civilizations. Technologies are neutral because they stand essentially under the very same norm of efficiency in any and every context.

Given this understanding of technology, the only rational stance is unreserved commitment to its employment. Of course, we might make a few exceptions and refuse to use certain devices out of deference to moral or religious values. Reproductive technologies are a case in point. Even if one believes that contraception, abortion, test tube babies are value-neutral in themselves, and, technically considered, can only be judged in terms of efficiency, one might renounce their use out of respect for the sacredness of life.

This approach places "trade-offs" at the center of the discussion. "You cannot optimize two variables" is the fundamental law of the instrumental theory of technology. There is a price for the achievement of environmental, ethical or religious goals, and that price must be paid in reduced efficiency. On this account, the technical sphere can be limited by non-technical values, but not transformed by them.[3]

The instrumentalist understanding of technology is especially prominent in the social sciences. It appears to account for the tensions between tradition, ideology and efficiency which arise from socio-technical change. Modernization theory, for example, studies how elites use technology to promote social change in the course of industrialization. And public policy analysis worries about the costs and consequences of automation and environmental pollution. Instrumentalism provides the framework for such research.

*Substantive Theory*

Despite the common sense appeal of instrumental theory, a minority view denies the neutrality of technology. Substantive theory, best known through the writings of Jacques Ellul and Martin Heidegger, argues that technology constitutes a new type of cultural system that restructures the entire social world as an object of control.[4] This system is characterized by an expansive dynamic which ultimately overtakes every pretechnological enclave and shapes the whole of social life. The instrumentalization of society is thus a destiny from which there is no escape other than retreat. Only a return to tradition or simplicity offers an alternative to the juggernaut of progress.

Something like this view is implied in Max Weber's pessimistic conception of an "iron cage" of rationalization, although he did not specifically connect this projection to technology. Ellul makes that link explicit, arguing that the "technical phenomenon" has become the defining characteristic of all modern societies regardless of political ideology. "Technique," he asserts, "has become autonomous."[5] Heidegger agrees that technology is relentlessly overtaking us. We are engaged, he claims, in the transformation of the entire world, ourselves included, into "standing reserves," raw materials to be mobilized in technical processes.[6] Heidegger asserts that the technical restructuring of modern societies is rooted in a nihilistic will to power, a degradation of man and Being to the level of mere objects.

This apocalyptic vision is often dismissed for attributing absurd, quasi-magical powers to technology. In fact, its basic claims are all too believable. The substitution of "fast food" for the traditional family dinner can serve as a humble illustration of the unintended cultural consequences of technology. The unity of the family, ritually reaffirmed each evening, no longer has a comparable locus of expression. No one claims that the rise of fast food "causes" the decline of the traditional family, but the correlation is surely significant.

An "instrumentalist" might reply that well prepared fast food supplies a nourishing meal without

needless social complications.This objection is blind to the cultural implications of technology. Instrumentalist theory treats "eating" as if it were merely a matter of ingesting calories, while all the ritualistic aspects of food consumption are secondary to this biological need. In adopting a strictly functional point of view, we have determined that eating is a technical operation that may be carried out with more or less efficiency.

This example can stand for a host of others in which the transition from tradition to modernity is judged to be a progress by a standard of efficiency intrinsic to modernity and alien to tradition. The substantive theory of technology attempts to make us aware of the arbitrariness of this construction, or rather, its cultural character. The issue is not that machines have "taken over," but that in choosing to use them we make many unwitting cultural choices. Technology is not simply a means but has become an environment and a way of life. That is its "substantive" impact.[7]

It seems that substantive theory could hardly be farther from the instrumentalist view of technology as a sum of neutral tools. Yet I will show in the next section that these two theories share many characteristics that distinguish them from a third approach I will introduce, the critical theory of technology.

# Technology Bound and Unbound

Despite their differences, instrumental and substantive theories share a "take it or leave it" attitude toward technology. On the one hand, if technology is a mere instrumentality, indifferent to values, then its design and structure is not at issue in political debate, only the range and efficiency of its application. On the other hand, if technology is the vehicle for a culture of domination, then we are condemned either to pursue its advance toward dystopia or to regress to a more primitive way of life. In neither case can we change it: in both theories, *technology is* destiny. Reason, in its technological form, is beyond human intervention or repair.

This is why most proposals for the reform of technology seek only to place a boundary around it, not to transform it. We are told, for example, that the harm we do the environment can be reduced by returning to a more natural way of life, without cars, trash compactors, and nuclear energy. The hi-tech medicalization of childbirth and dying are criticized for penetrating "too far" into zones where nature should be allowed to take its course. Reproductive technologies are under constant attack on religious grounds. Genetic engineering is the ultimate biohazard. In all these cases critics urge us to reject certain technologies, and then ask us to accept the price of preserving traditional or natural ways. This agenda has given rise to both moral and political solutions to the problem of modern technology.

*Moral Boundaries*

While political conservatives seek to reinvigorate institutions such as the family on a traditional basis, cultural conservatives focus on spiritual values. Ellul and Heidegger, for example, condemn the reduction of our ethical, political and human existence to a mere instrument for the achievement of wealth and power, and call for a restoration of the holy. Progressives worry about the subversion of democratic institutions by technology. Jurgen Habermas argues that the public life of democratic societies presupposes a commitment by the citizens to engage in rational argument. To the extent that we technologize the public sphere by transferring its functions to experts, we destroy the very meaning of democracy. "The redeeming power of reflection cannot be supplanted by the extension of technically exploitable knowledge."[8]

Albert Borgmann offers a sophisticated version of the idea of a return to simplicity. He calls for a "two-sector" economy in which an expanding craft sector will take up the slack in employment from an increasingly automated economic core. This view is premised on an uncritical acceptance of the dominant technological paradigm which, Borgmann asserts, "is perfect in its way."[9] But is modern industrial technology really "perfect" in conception and design? Is it not rather a human and environmental disaster? And how can one confine this disaster to its proper sphere, as all these theorists suggest, when the problems it creates overflow every boundary and shape the whole framework of social life?

Let me put some order in this barrage of objections. There are at least four reasons to doubt that moral solutions will work.

1. I am in full agreement with a view of technical progress that refuses its imperialism and regards it as relative to other dimensions of human existence. But it is just as important to conceptualize the progressive transformation of technology as to define its limits. All too often, having defined technology's proper place, criticism fails to see its potential and, in condemning its current form, forecloses its possible future.

2. Suppose, however, that one succeeds in combining limits on technology's reach with an effort to reform it within its own domain. The problem still remains of defining that domain. It is extraordinarily difficult to reach agreement on which activities should be protected from technical mediation: is it childbirth? the family? politics? ethnic or religious traditions? The only consensus value left in modern societies is efficiency, precisely the value we are attempting to bound so that other values may flourish.

3. Furthermore, by placing spiritual values in rigid opposition to technology, we concede what needs to be defended, i.e. the possibility of a technically rational civilization that enhances rather than undermines those values. The moral critique of technology always seems to reopen the tedious debate over "principles" vs. "practicality." In a democratic society that is no debate but a confession of impotence, since the victory of the practical is so very predictable. What is needed is an alternative practicality more in accord with principle. That is what traditional Marxism promised, but failed to deliver. The question posed for us today is whether we can do any better.

4. Finally, the very project of bounding technology appears suspect. If we *choose* to leave something untouched by technology, is that not a subtler kind of technical determination? Have I not domesticated a wild tree or bush if I plant around it in such a way as to bring out its beauty? (This is a standard technique of Japanese gardening.) If I suddenly need meaning in my overly technologized life, and obtain it by returning to my family's religious traditions, am I not *using* religion as a kind of super technology? If so, how can I believe in it? How can I ever leave the technical sphere if the very act of bounding a reservation instrumentalizes it?

*Political Boundaries*

The political solution to the problem of bounding technology turns out to be no more promising. This solution has been tested by those countries that attempt to preserve indigenous values while modernizing technically. Typically, the rulers argue that the flaws of modern society are the result of a specific instrumentalization of technology. They view Western capitalism and its peculiar techno-culture as a system of "values" of the same order as, for instance, Confucianism or Islam. Their goal is to build sub-regional economic and cultural spheres, sheltered from the world market and Western cultural hegemony, where modern technology will be in the service of these alternatives.

Apart from the many rhetorical gestures in this direction, there have been two serious challenges to Western hegemony. Pre-war Japan tested the power of tradition to resist modernization, while Russia tried to bend modernization to communist purpose. The strategy in these cases was remarkably similar despite immense national and ideological differences.

In the late 19th century, Japan committed itself to importing and manufacturing Western technology on a vast scale as a means of preserving national independence. Drowning in foreign technology, cultural conservatives could not help wondering what sort of industrial society would have been created by Japanese inventors had they been left alone for another century. Thus the novelist Tanizaki wrote in 1933 that "The Orient quite conceivably could have opened up a world of technology entirely its own."[10]

In any case, so successful was the technology transfer that the Japanese came to believe they were destined to lead all Asia, not merely economically and militarily but culturally as well. The struggle to "overcome (European) modernity" (*kindai no* chokoku) attracted the support of many of the most sophisticated writers and philosophers in Japan in the 1940s. "The problem was to find a way to conceptualize a modernity that was made in Japan, not in the West."[11]

But despite serious reflection, these intellectuals came up with no concrete alternatives, nothing to indicate that a Japanese victory would have opened the way to an original form of modern society. The Japanese defeat in World War II marked the end of the struggle for a specifically oriental form of modern culture, although the idea is periodically brought up in Japan for reconsideration. Now that Japan has joined the world market,its assimilation into international techno-culture seems probable. The failure of Japan's early attempt to preserve its cultural originality foreshadowed all the later struggles to preserve vestiges of tradition and ethnicity in the face of technology's universalizing pressures.

The Soviet experience resembles that of Japan except that the Russian Revolution was oriented toward values that would be realized in the future rather than toward values from the past. Once again, the protection of these values required the energetic acquisition of existing technology to achieve rapid economic development. Thus despite certain substantivist implications of the Marxist theory of economic stages, the Soviet regime adopted a typical instrumentalist position on technology, using and importing it as though it were a neutral tool. This is the significance of Lenin's famous remark that communism is "electrification plus soviets." Tight control of economic and cultural interaction with the capitalist world was supposed to open a protected space within which a new culture would be born.

This experiment appears to be over now, drained of its heroic ambitions by the banality of bureaucratic corruption, incompetence and irresponsibility. Russia no longer believes itself capable of organizing an autonomous sub-region in the world economy, and has called on the West to involve itself directly in the development of communist and formerly communist economies. The loss of cultural control is so complete that no turning back seems possible. (It is difficult to believe in the rearguard defense of cultural isolationism in China in the context of intensified economic exchanges with the West.)

Instrumental theory of technology is not entirely refuted by these experiences, although in each case governments were unable to use technology to further original cultural goals. Defenders of the instrumental view sometimes draw comfort from the conjunction of democratic reform with the decision for Westernization. Ordinary citizens appear to have refused the trade-offs required to sustain traditional or future-oriented values in competition with well being in the present. The conquest of society by technology is not due to any occult power of the "technical phenomenon"; rather, technology, as a domain of perfected instruments for achieving well being, is simply a more

powerful and persuasive alternative than any ideological commitment.

At this point the specificity of the instrumental theory collapses. If technology is truly neutral, it should be able to serve a plurality of ends. But the close association of mass democracy with cultural Westernization seems to deny that pluralism, and in fact confirms the arguments of substantive theory. There is little reason to distinguish the two theories if they disagree only in their attitude toward an outcome foreseen by both.

A more interesting argument divides the substantive approach from Marxist critical theory. Both can agree that the Japanese and Soviet examples differed only superficially from the Western civilization they professed to transcend. Substantive theorists see this as evidence that no alternative technological civilization is possible. But critical Marxism argues, on the contrary, that an alternative may yet be created on the basis of workers' control, requalification of the labor force, and public participation in technical decisions. If the Japanese and Soviet experiments failed, this is because they rejected the democratic path for one convergent with authoritarian industrialism.

According to this view, the attempts of states to instrumentalize technology on behalf of original values founder on an internal contradiction. In the face of the technological challenge, only a particularly strong state can create a culturally and economically closed region for the furtherance of original cultural goals. Yet paradoxically a strong state can only sustain itself by employing the authoritarian technical heritage of capitalism. In so doing, it reproduces all the main features of the civilization it professes to reject: predictably, the means subvert the ends.[12] This argument points toward a democratic reconceptualization of socialism outside the framework of geographical utopianism.

# Critical Theory of Technology

Whatever the merits of placing moral and political limits on technology in particular cases, history seems to show that it is impossible to create a fundamentally different form of industrial civilization through a different instrumentalization of the existing technological base. If this is so, then either Heidegger is right, and "Only a god can save us now," or we must invent a politics of technological transformation.[13]

The second option characterizes the *critical theory* of technology, which charts a difficult course between resignation and utopia. This theory analyzes the new forms of oppression associated with modern industrialism, and argues that they are subject to new challenges. But, having renounced the illusion of state-sponsored civilizational change, critical theory must cross the enormous cultural barrier that separates the heritage of the radical intelligentsia from the contemporary world of technical expertise. It must explain how modern technology can be redesigned to adapt it to the needs of a freer society.

The first halting steps in this direction were taken by the early Marxist Lukacs and the Frankfurt School. Their theories of "reification," "totalitarian enlightenment," and "one-dimensionality" show that the conquest of nature is not a metaphysical event, but begins in social domination. The remedy is therefore not to be found in spiritual renewal but in a democratic advance. The Frankfurt School also addressed the fear that socialism might simply universalize the Promethean technicism of modern capitalism. The liberation of humanity and the liberation nature are connected in the idea of a radical reconstruction of the technological base of modern societies. But with the notable exception of Marcuse, these Marxist critics of technology stop short of actually explaining the new relation to nature implied in their program, and none of them come close to meeting the demand their work elicits for a concrete conception of the "new technology" they invoke.[14]

This book will construct a new formulation of the critical theory of technology to address these issues. That formulation resembles substantive theories in arguing that the technical order is more than a sum of tools and in fact structures (or, in Heidegger's terms, "enframes") the world in a more or less "autonomous" fashion. In choosing our technology we become what we are, which in turn shapes our future choices. The act of choice is technologically embedded and cannot be understood as a free "use" in the sense intended by instrumental theory. However, critical theory denies that "modernity" is exemplified once and for all by the type of atomistic, authoritarian, consumer oriented culture we enjoy in the West. There is no one single "technical phenomenon" which can be characterized and rejected as a whole in the manner of Ellul.

Thus critical theory agrees with instrumentalism in rejecting the fatalism of an Ellul or a Heidegger.[15] It does not despair in the face of the triumph of technology, nor call for a renewal of the human spirit from a realm beyond society such as religion or nature. The choice of civilization is not decided by the immanent drift of technology, but can be affected by human action. Political struggle, as a spur to cultural and technical innovation if not necessarily in its traditional statist form, continues to play a role.

Despite these points of agreeement with instrumentalism, critical theory rejects the neutrality of technology and argues instead that "technological rationality has become political rationality."[16] The values and interests of ruling classes and elites are installed in the very design of rational procedures and machines even before theseare assigned a goal. The dominant form of technological rationality is neither an ideology (an essentially discursive expression of class self-interest) nor is it a neutral requirement determined by the "nature" of technique. Rather, it stands at the intersection between ideology and technique where the two come together to control human beings and resources in conformity with what I will call "technical codes." Critical theory shows how these codes invisibly sediment values and interests in rules and procedures, devices and artifacts that routinize the pursuit of power and advantage by a dominant hegemony.

Critical theory argues that technology is not a thing in the ordinary sense of the term, but an "ambivalent" process of development suspended between different possibilities. This "ambivalence" of technology is distinguished from neutrality by the role it attributes to social values in the design, and not merely the use, of technical systems. On this view, technology is not a destiny but a scene of struggle. It is a social battlefield, or perhaps a better metaphor would be a *parliament of things* on which civilizational alternatives are debated and decided.

# Civilizational Change

Civilizations define a human type. Characteristic cultural, social, geographical and economic conditions shape civilizations and distinguish them from each other. In the past, civilizational alternatives have emerged within every mode of production around the roles of age, sex, or status, the functions of religion, art or warfare, the available technologies, and so on. There is not just *one* form of tribal life, *one* feudal civilization or absolute monarchy, but a multiplicity in every case. But today, for the first time, there appears to be only one possible industrial civilization. It gradually homogenizes every other difference as it subverts all traditional values and obliterates geography.

Critical theory holds that there can be at least two different technological civilizations based on different paths of technical development. The starting points of a new path are not to be sought in speculative fantasies but among subordinated elements of the existing technical system. Technologies corresponding to different civilizations thus coexist uneasily within our society. We can already sense the larger stakes implicit in the technical choice between production by assembly lines or work teams, designing computers to intensify control or to expand communication, building

cities around automobiles or public transportation. The instrumentalist notion of "use" does not apply at this level because the consistent pursuit of one or another technical path defines the user as one or another human type, member of one or another civilization.

If a different technological civilization cannot emerge from ethics, ideology or ethnicity, it must be based on a distinction immanent to the technical sphere itself. As Don Ihde puts it, "Any larger gestalt switch in sensibilities will have occur from *within* technological cultures."[17] The most significant such distinction is the power differential between those who command and those who obey in the operation of technical systems. That power differential, organized and capitalized through a variety of institutions, is one of the foundations of the existing technological civilization in both its capitalist and communist forms. Since the locus of technical control influences technological development, new forms of control from below could set development on an original path.

Marx first proposed this idea, arguing that an economy controlled by workers would be able to redesign technology to apply high levels of skill to production. He believed that deep changes in education, politics and social life would flow from the requalification of the labor force. Although communist regimes deferred this prospect into an ever receding future, self-management theorists have long advocated giving worker controlled firms command of their own technical development to enable them to initiate radical technological change.

This approach has been given a new lease on life in recent Marxist theory of the labor process.[18] Harry Braverman, and the generation of theorists who followed his lead, show in detailed studies how economic interests determine major features of technological design. They argue that capitalism introduced control from above to impose labor discipline on a workforce with no stake in the firm. Technology was gradually redesigned in response to this new form of control to replace skilled workers with more malleable unskilled ones.

Samuel Bowles and Herbert Gintis have traced the impact of these economic and technical changes on the educational system, which was reorganized to provide capitalist industrialism with the type of workers it required. They show that the problems identified by Braverman are not confined to the workplace but shape cultural and social life as a whole.[19]

This account reverses the usual order of explanation for the prevalence of the unskilled and uneducated, attributing it not to the general advance of technology, or to the natural distribution of intelligence, but instead to social causes. That conclusion suggests the social *contingency* of modern technology, which has unexplored democratic potentialities that might be realized through a change in the locus of control.[20]

In recent years, activists involved in urban and environmental politics, and the politics of race and gender, have challenged traditional Marxism and called into question the significance of economic planning and workers' control.[21] The turn away from Marxism is reflected in theory, most notably in the work of Michel Foucault. His historical studies of the rationalization process uncover the roots of modern power structures in a variety of social techniques, and emphasize the dispersion of power throughout a wide range of institutions such as prisons, medicine, education, and so on.

But whatever the merits of these challenges, the new terrains of struggle privileged by "post-Marxism" are also traversed by technical mediations that support power differentials broadly similar to that which characterizes the industrial setting. Change is still promised through substituting control from below for control from above. Foucault's work in particular advocates new forms of resistance to the exercise of power through technical strategies. Thus despite the polemic

that opposed Foucault and "the Marxist conception, or at any rate a certain conception currently held to be Marxist," his approach offers another important source for a critical theory of technology.[22]

Is a shift in the locus of technical control possible? There are both cultural and technical objections to this proposal. Radical democratization presupposes the desire for increased responsibility and power, but the citizens of industrial societies today appear to be more anxious to "escape from freedom" than to enlarge its range. I will not argue with this view, but it is simply dogmatic to dismiss a reversal of current trends as impossible. Things were different as recently as the 1960s and may change in the future as the full scope of worldwide environmental crisis finally sinks in.

The emergence of a *culture of responsibility* would alter non-economic institutions and gender roles as well as the workplace. I do *not* argue that the latter is the determining instance of a general civilizational change. But in an industrial society, where so many social and political choices are made by management, democratization of work is indispensable to a more participatory way of life. And it is precisely in the domain of work that democratization poses the most difficult problems, or at least so it is widely believed.

Technological civilization is supposed to be inherently incompatible with mass participation. Certainly, this is the implication of progress in the sphere of production through the relentless replacement of muscular power, manual skills, and finally intelligence by advancing technology. Reduced to passive robots at work, the members of industrial society are unlikely to acquire the educational and characterological qualifications for active citizenship.

This objection points to a deep problem in the usual formulations of social democracy, which are primarily concerned with the extension of welfare and formal participation in economic decisions. These formulations often appeal to a negative concept of freedom in opposition to utopian projections which they dismiss as impractical or even totalitarian. But insofar as they remain procedural in emphasis, these theories avoid utopianism at the expense of trivializing or evading the civilizational issues they must confront to carry conviction. They promise fundamental social change without challenging the structures of daily life that determine a political culture of passivity and dependency.

But can one go beyond procedure without falling into all the dilemmas of a positive concept of freedom? This question has particular relevance today in the light of the widespread belief that a society that achieved morally sanctioned goals, such as increased participation, social justice, or environmental compatibility, would necessarily be the poorer for it. There is no hope for socialism if it is merely a utopian ideology against which wealth might be traded off. Brief experiments in heroic virtue of that sort occasionally occur, but sooner or later they collapse in popular exhaustion and thus do not represent a realistic civilizational alternative. To escape what I call the "dilemma of development," the hard choice between virtue and prosperity, one must show that there are coherent configurations of human and technical resources that would support the efficient operation of a democratically controlled economy. Instead of seeking costly trade-offs between such goals as participation and efficiency, environmentalism and productivity, innovative redesign of technology must bring these goals into harmony.

# The Critical Alternatives

This is a line of argument familiar at least since Mumford and Marcuse, however, its economic and technical implications have not been worked out far enough to carry conviction. I explore these implications in terms of the concept of "real possibility" or "potentiality," to distinguish it from

mere technical feasibility. I argue that the existing society contains the suppressed potentiality for a *coherent civilizational alternative* based on a system of mutually supporting transformations of social institutions, culture, and technology.

Most participants in contemporary debates on society and technology do not share this view because they regard the very notion of potentiality as outdated and metaphysical. I believe this would be a fair statement of Habermas's objection, and certainly that of many more conservative theorists who, like Habermas, are in full flight from what they perceive as the utopian heritage of Marxism. Unfortunately, these theorists all lapse back into a conformist view of the neutrality of technology that leaves them little critical margin.

Without the concept of potentiality, can one sustain a radical stance? This question divides so-called "post-modern" critique from Critical Theory. Post-modernism attacks all forms of totalizing discourse, including talk of potentiality, in the belief that totalization is the logic of technocracy.[23] There is surely a moment of truth in the demand for dispersion and difference, but I believe that these purely negative qualifications are an insufficient basis for a critical theory of technology.

Nuclear weapons, the systematic deskilling of the labor force, the export of pollution to the Third World, these are not the products of rigid bureaucracies the authority of which is sapped by a new post-modern individualism, but of flexible centers of command that are well adapted to the new technologies they have designed and implemented. The opposition to these centers must also oppose the present trend of technological design. But for that we need a positive perspective on how technology should be transformed.

There is an influential strand of "Green" and "ecofeminist" theory, represented for example by Carolyn Merchant, that formulates the project of technological reform in terms of a recovery of the body and bodily involvement in nature.[24] This view seems to imply a kind of vitalist re-enchantment of nature that contradicts the world picture of the modern physical and biological sciences. The potentialities to which these theorists refer would then be ontologically real dimensions of human beings and nature ignored by current science but identified by a reformed science of the future.

Someday, there may well be a scientific world picture more in accord with the spirit of contemporary ecological thought. But we need not await the reform of science to reform technological design. On the contrary, current scientific and technical knowledge has resources for a very radical reconstruction of the technological heritage if these are appropriated in the right spirit.

I argue that the technical enterprise itself is immanently disposed to address the demands we formulate as potentialities, but that it is artificially truncated in modern industrial societies. Opening technical development to the influence of a wider range of values is a technical project requiring broad democratic participation. Radical democratization can thus be rooted in the very nature of technology, with profound substantive consequences for the organization of industrial society. This approach does not involve an ontological challenge to modern science and leaves no opening for the charge of totalitarian utopianism. In strategic terms, it identifies the common ground between critical theory and the scientific and technical professions.

I pursue this argument through an analysis of the nature of technology and the technical relation. I show that the control-oriented attributes of technology emphasized in capitalist and communist societies do not exhaust the potentialities of modern industrialism. A fundamentally different form of civilization will emphasize other attributes of technology compatible with a wider distribution of cultural qualifications and powers. Such attributes are present in both preindustrial crafts and modern professions. They include the vocational investment of technical subjects in their work,

collegial forms of self-organization, and the technical integration of a wide range of life enhancing values, beyond the mere pursuit of profit or power. Today these dimensions of technology can be brought into play only in the context of the democratic reorganization of industrial society, which they make possible. The argument for this position occupies the remaining chapters of this book.

## NOTES

1. Karl Mannheim, *Ideology and* Utopia, trans. L. Wirth and E. Shils, (New York: Harcourt Brace, 1936), p. 262.

2. This distinction is drawn from Albert Borgmann, *Technology and the Character of Contemporary Life* (Chicago: Univ. of Chicago Press, 1984), p. 9.

3. See, for an example, Nicholas Rescher, "What is Value Change? A Framework for Research," in K. Baier and N. Rescher, eds., *Values and the Future* (New York: The Free Press, 1969.) Emmanuel Mesthene suggests that rather than limiting technology, values will change to take advantage of the new oppotunities it creates. (*Technological Change* (New York: Signet, 1970), pp. 48-57.)

4. For a review of this trend, see Langdon Winner, *Autonomous Technology* (Cambridge, Mass.: MIT Press, 1977).

5. Jacques Ellul, *The Technological* Society, J. Wilkinson, trans. (New York: Vintage, 1964), p. 14.

6. Martin Heidegger, *The Question Concerning* Technology, W. Lovitt, trans. (New York: Harper and Row, 1977), p. 17.

7. For a further elaboration of examples such as these, see Borgman, *op*. cit., pp. 204 ff.

8. Jurgen Habermas, *Toward a Rational* Society, J. Shapiro, trans., (Boston: Beacon, 1970), p. 61. For the limitations of Habermas's attempt to bound the lifeworld, see Nancy Fraser, "What's Critical about Critical Theory: The Case of Habermas and Gender," S. Benhabib and D. Cornell, eds., *Feminism as Critique* (Cambridge: Polity Press, 1987).

9. Borgmann, *op*. cit., p. 220. For a powerful statement of the radical version of the two-sector thesis, see Andre Gorz, *Adieux au Proletariat* (Paris: Galilee, 1980); and Andre Gorz, *Metamorphoses du Travail Quete du Sens* (Paris: Galilee, 1988).

10. Jun'ichiro Tanizaki, *In Praise of* Shadows, Harper and Seidensticker, trans. (New Haven: Leete's Island Books, 1977), p. 7

11. H. D. Harootunian, "Visible Disources/Invisible Ideologies," in *Postmodernism and* Japan, Masao Miyoshi and H. D. Harootunian, eds., (Durham: Duke Univ. Press, 1989), p. 75.

12. Cf. Frederic J. Fleron, Jr., ed., *Technology and Communist Culture: The Socio-cultural Impact of Technology Under Socialism* (New York: Praeger, 1977), pp. 471 ff.

13. The quotation is from an interview with *Der Spiegel* entitled "Only a God can Save Us Now," held shortly before Heidegger's death (D. Schendler, trans., *Graduate Faculty Philosophy* Journal, vol. 6, no. 1, Winter, 1977).

14. The most powerful statement of this position prior to the publication of *One-dimensional Man* was Theodor Adorno and Max Horkheimer, *Dialectic of* Enlightenment, J. Cummings, trans. (New York: Herder and Herder, 1972). For Marcuse's positive theory of technological transformation, see Andrew Feenberg, "The Bias of Technology," R. Pippen, A. Feenberg, and R. Webel, eds., *Marcuse: Critical Theory and the Promise of Utopia* (Amherst, Mass.: Bergin & Garvey, 1988), pp. 251-254.

15. Qualifying Heidegger and Ellul as "fatalistic" seems reasonable despite the protests of their advocates. How else can one describe a view that says, "We can at most only wake the readiness for the expectation [of God]?" (Heidegger, *op*. cit., p. 18). Ellul's defenders present him as delivering essentially the same message. Cf. Clifford Christians, "Ellul on Solution: An Alternative but No Prophecy," in *Jacques Ellul: Interpretive* Essays, C. Christians and J. M. Van Hook, eds., (Urbana: Univ. of Illinois Press, 1981), p. 153.

16. Herbert Marcuse, *One-dimensional Man* (Boston: Beacon, 1964), pp. xv-xvi.

17. Don Ihde, *Technology and the Lifeworld* (Bloomington and Indianapolis: Indiana Univ. Press, 1990), p. 200. 18. The first and most influential book in this field was Harry Braverman, *Labor and Monopoly Capital* (New York: Monthly Review, 1974). For a general review of the Marxist theory of the labor process, see Paul Thompson, *The Nature of Work* (London: MacMillan, 1983).

19. Samuel Bowles and Herbert Gintis, *Schooling in Capitalist America* (New York: Basic Books, 1976). "Different levels of education feed workers into different levels within the occupational structure and, correspondingly, tend toward an internal organization comparable to levels in the hierarchical divison of labor" (p. 132.)

20. See the discussion of contingent development in Donald MacKenzie, "Marx and the Machine," *Technology and* Culture, July 1984, vol. 25, no. 3, pp. 501-502. For an economic argument for contingency, see Brian Arthur, "Competing Technologies, Increasing Returns, and Lock-In by Historical Events," *The Economic* Journal, 99 (March 1989).

21. For an analysis of these movements, see Carl Boggs, *Social Movements and Political Power* (Philadelphia: Temple Univ. Press, 1986).

22. Michel Foucault, Power/Knowledge, Colin Gordon, ed., (New York: Pantheon, 1980), p. 88. The enlistment of Foucault in the struggle against academic Marxism in America is complicated by the difference between the orthodox Marxism Foucault explicitly attacks and American Marxist trends, influenced by the Frankfurt School. Despite certain differences, Foucault is not an adversary of the Frankfurt School. He writes, "Now, obviously, if I had been familiar with the Frankfurt School, if I had been aware of it at the time, I would not have said a number of stupid things that I did say and I would have avoided many of the detours which I made while trying to pursue my own humble path--when, meanwhile, avenues had been opened up by the Frankfurt School." (Michel Foucault, *Politics, Philosophy,* Culture, trans. A. Sheridan, et. al., (New York: Routledge, 1988), p. 27). As Mark Poster writes, "Foucault is continuing the work of the Western Marxists by other means." (Mark Poster, *Foucault, Marxism and History* (Cambridge: Polity Press, 1984), p. 40.) Cf. Peter Dews, *Logics of Disintegration* (London: Verso, 1987), pp. 150ff.

23. Jean-Francois Lyotard, *The Postmodern Condition: A Report on* Knowledge, G. Bennington and B. Massoumi, trans., (Minneapolis: University of Minnesota Press, 1984). See Martin Jay, *Marxism and Totality: The Adventures of a Concept from Lukacs to Habermas* (Berkeley: University of California Press, 1984), Epilogue.

24. Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (New York: Harper and Row, 1980).