

# Marcuse or Habermas: Two Critiques of Technology

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## *Abstract*

The debate between Marcuse and Habermas over technology marked a significant turning point in the history of the Frankfurt School. After the 1960s Habermas's influence grew as Marcuse's declined and Critical Theory adopted a far less utopian stance. Recently there has been a revival of quite radical technology criticism in the environmental movement and under the influence of Foucault and constructivism. This article takes a new look at the earlier debate from the standpoint of these recent developments. While much of Habermas's argument remains persuasive, his defense of modernity now seems to concede far too much to the claims of autonomous technology. His essentialist picture of technology as an application of a purely instrumental form of nonsocial rationality is less plausible after a decade of historicizing research in technology studies. The article argues that Marcuse was right after all to claim that technology is socially determined even if he was unable to develop his insight fruitfully. The article derives a new approach to technology criticism from both constructivism and Habermas's communication theory. The essence of technology is shown to be historical and reflexive, like the essence of other social institutions. As such an institution, its rationality is always implemented in value-biased forms subject to political critique.

## *I. Introduction*

In this essay I confront Marcuse and Habermas's views on technology and propose an alternative which combines elements of both. A synthesis is possible because the two different traditions of critique on

which these thinkers draw are complementary. However, as we will see, neither thinker comes out of the confrontation unscathed.

The critique of technology as such characterizes the Frankfurt School and especially its leading members, Adorno and Horkheimer. In *Dialectic of Enlightenment* (1972) they argue that instrumentality is in itself a form of domination, that controlling objects violates their integrity, suppresses and destroys them. If this is so, then technology is not neutral, and simply using it involves taking a valiative stance.

The critique of technology as such is familiar not only from the Frankfurt School but also from Heidegger (1977), Jacques Ellul (1964), and a host of social critics who might be described unkindly as technophobic. Generally this sort of critique is placed in a speculative framework. Heidegger's theory of technology is based on an ontological understanding of being; a dialectical theory of rationality does the same work for the Frankfurt School. These sweeping theories are not entirely convincing, but they are a useful antidote to positivist faith in progress and bring into focus the need for limits on technology. However, they are too indiscriminate in their condemnation of technology to guide efforts to reform it. The critique of technology as such usually ends in retreat from the technical sphere into art, religion, or nature.

Reform of technology is the concern of a second approach which I call design critique. Design critique holds that social interests or cultural values influence the realization of technical principles. For some critics, it is Christian or masculinist values that have given us the impression that we can "conquer" nature, a belief that shows up in ecologically unsound technical designs; for others it is capitalist values that have turned technology into an instrument of domination of labor and exploitation of nature (White, [1972]; Merchant, [1980]; Braverman, [1974]).

These theories are sometimes generalized into versions of the critique of technology as such. Then their relevance to design is lost in favor of essentialist condemnation of any and all technical mediation. But

where the essentialist temptation is avoided and the critique confined to our technology, this approach promises a radically different technical future based on different designs embodying a different spirit. On this account technology is social in much the same way as law or education or medicine insofar as it is similarly influenced by interests and public processes. Critics of the Fordist labor process and environmentalism have challenged technical designs on these terms for twenty-five years (Hirschhorn, [1984]; Commoner, [1971]). More recently, this view has found broad empirical support in constructivist sociology of science and technology (Bijker, Hughes, Pinch, [1989]).

Although he is often seen as a romantic technophobe, Marcuse belongs in this camp. He argues that instrumental reason is historically contingent in ways that leave a mark on modern science and technology. He mentions the assembly-line as an example; however, his aim is not to challenge any particular design but rather the epochal structure of technological rationality which, unlike Heidegger and Adorno, he regards as changeable. He claims that there could be forms of instrumental reason other than that produced by class society. A new type of instrumental reason would generate a new science and new technological designs freed of the negative features of our science and technology. Marcuse is an eloquent advocate of this ambitious position, but today the notion of a metaphysically inspired transformation of science has a vanishingly small audience and discredits his whole approach.

Habermas offers a modest demystified version of the critique of technology as such. Instrumental action, including technical action, has certain characteristics which are appropriate in some spheres of life, inappropriate in others. Habermas's approach implies that in its proper sphere technology is neutral, but outside that sphere it causes the various social pathologies that are the chief problems of modern societies. Although his position too is powerfully argued, the idea that technology is neutral, even with Habermas's qualifications, is reminiscent of the naive instrumentalism so effectively laid to rest by constructivism.

The question I address here is, what can we learn from these two thinkers assuming that we are neither metaphysicians nor instrumentalists, that we reject both a romantic critique of science and the neutrality of technology?

In the following discussion, I work through the argument in three phases. I start with Habermas's critique of Marcuse in "Technology and Science as 'Ideology'" (1970), the locus classicus of this debate. Then I consider the deeper presentation of similar themes in Habermas's *The Theory of Communicative Action* (1984, 1987) where he reformulates the problems in Weberian terms. Of course Marcuse was not able to reply to these arguments so my procedure is anachronistic, but I will do my best to imagine how he might have responded on the basis of his own critique of Weber. Next, I discuss aspects of Habermas's theory that can be reconstructed to take the Marcusean critique into account. Finally, I offer my own formulation of an alternative approach.<sup>2</sup>

## *II. From "Secret Hopes" to New Sobriety*

Marcuse follows Adorno and Horkheimer's *Dialectic of Enlightenment* in arguing that both inner and outer nature are suppressed in the struggle for survival in class society. To carry any critical weight, this position must imply, if not an original unity of man nature, at least the existence of some natural forces congruent with human needs and that have been sacrificed in the course of history. Like his Frankfurt School colleagues, Marcuse believes such forces are manifested in art. But today even consciousness of what has been lost in the development of civilization is largely forgotten. Technical thinking has taken over in every sphere of life, human relations, politics, and so on.

Although *One-Dimensional Man* (1964) is often compared to *Dialectic of Enlightenment*, it is far less pessimistic. In putting forward a more hopeful view, Marcuse appears to be influenced by Heidegger, although he does not acknowledge this influence, perhaps because of their deep political disagreements. In Heideggerian terms, Marcuse proposes a new disclosure of being through a

revolutionary transformation of basic practices (Dreyfus, [1995]). This would lead to a change in the very nature of instrumentality, which would be fundamentally modified by the abolition of class society and its associated performance principle. It would then be possible to create a new science and technology which would be fundamentally different, which would place us in harmony with nature rather than in conflict with it. Nature would be treated as another subject instead of as mere raw materials. Human beings would learn to achieve their aims through realizing nature's inherent potentialities instead of laying it waste in the interest of narrow short-term goals such as power and profit.

Aesthetic practice offers Marcuse a model of a transformed instrumentality, different from the "conquest" of nature characteristic of class society. The early twentieth century avantgarde, especially the surrealists, seems to be the source of this idea. Like them, Marcuse believed that the separation of art from daily life could be transcended through the fusion of reason and imagination. *An Essay on Liberation* (1969) proposes the *Aufhebung* of art in a new technical base. Although this program sounds wildly implausible, it makes a kind of intuitive sense. For example, the contrast between the architecture of Mies van der Rohe and Frank Lloyd Wright suggests the difference between technology as a manifestation of untrammelled power and another kind of technology that harmonizes with nature, that seeks to integrate human beings with their environment.<sup>3</sup>

Habermas is not convinced. In "Technology and Science as 'Ideology'" he denounces the "secret hopes" of a whole generation of social thinkers--Benjamin, Adorno, Bloch, Marcuse--whose implicit ideal was the restoration of the harmony of man and nature. He attacks the very idea of a new science and technology as a romantic myth; the ideal of a technology based on communion with nature applies the model of human communication to a domain where only instrumental relations are possible. Habermas follows the anthropologist Gehlen, for whom technical development supplements the human body and mind with one device after another. Thus technology is a generic project, "a 'project' of the human

species as a whole", not of some particular historical epoch like class society or of a particular class like the bourgeoisie (Habermas, 1970: 87).

In defense of Marcuse, it should be said that he nowhere proposes that a qualitatively different technical rationality would substitute an interpersonal relationship to nature for the objectivity characteristic of all technical action. It is Habermas who uses the phrase "fraternal relation to nature" to describe Marcuse's views. Marcuse does advocate relating to nature as to another subject, but the concept of subjectivity implied here owes more to Aristotelian substance than to the idea of personhood. Marcuse does not recommend chatting with nature but, rather, recognizing it as possessing potentialities of its own with a certain inherent legitimacy. That recognition should be incorporated into the very structure of technical rationality.

Of course Habermas would not deny that technological development is influenced by social demands, but that is quite different from the notion that there are a variety of technical rationalities, as Marcuse believes. Thus Habermas could agree that technology might be designed differently, for example, out of respect for ecological constraints, but he would still insist that it remains essentially unchanged by this or any other particular realization. Technology, in short, will always be a non-social, objectivating relation to nature, oriented toward success and control. Marcuse would argue, on the contrary, that the very essence of technology is at stake in the reform of the modern industrial system.

In any case, Habermas does not simply dismiss Marcuse, who no doubt had a considerable influence on him. In fact he finds in the concept of one-dimensionality the basis for a much better critique of technology than the one he rejects. This is Marcuse's version of the technocracy thesis according to which there is a tendency toward total administration in advanced societies. He developed this idea in terms of the overextension of technical modes of thinking and acting. For Habermas, this implies the need to bound the technical sphere so as to restore communication to its proper place in social life.

Paradoxically, although the germ of Habermas's famous "colonization thesis" appears to derive at least in part from Marcuse's critique of technology, technology itself drops out of the Habermasian equation at this point in time, and never reappears. As I will show, Habermas's theory could accommodate a critique of technology in principle, but the index of *The Theory of Communicative Action* does not even contain the word. This oversight is related to his treatment of technology as neutral in its own sphere. The neutrality thesis obscures the social dimensions of technology on the basis of which a critique could be developed.

What is the outcome of this first encounter? Despite the problems in his position, Habermas comes out best. Marcuse's views were forgotten in the late '70s and '80s. Of course there was something right about Habermas's critique, but it also had a favorable historical context. That context was the retreat from the utopian hopes of the '60s in the '80s, a kind of *neue Sachlichkeit*, or "new sobriety". Habermas's views suited a time when we tamed our aspirations.

### *III. Rationality in the Critique of Modernity*

Habermas regards the '60s radicals as anti-modern while defining his own position as critical of the "incompleteness" of modernity. Accordingly, *The Theory of Communicative Action* develops an implicit argument against Marcuse and the New Left in the name of a redeemed modernity.

I will review here one important version of Habermas's argument which I will explain in terms of Chart 1 (Habermas's figure 11), drawn from *The Theory of Communicative Action* (1984, 1987: I, 238).<sup>4</sup> Along the top, Habermas has listed the three "worlds" in which we participate as human beings, the objective world of things, the social world of people, the subjective world of feelings. We switch constantly between the three worlds in our daily life. Along the side are listed the "basic attitudes" we can take up with respect to the three worlds: an objectivating attitude which treats things, or people, or feelings as things; a norm-conformative attitude which views them in terms of moral obligation; and an expressive

attitude which approaches them emotively. Crossing the basic attitudes and worlds yields nine world-relations. Habermas follows Weber in claiming that only those world-relations can be rationalized that can be clearly differentiated and that can build on their past achievements in a progressive developmental sequence. Modernity is based on precisely those rationalizable world-relations. They appear in the stepped double boxes: cognitive-instrumental rationality, moral-practical rationality, and aesthetic-practical rationality.

Of the three possible domains of rationalization, only the objectivating relation to the objective and social worlds, which yields science, technology, markets and administration, has been allowed fully to develop in capitalist societies. Habermas concludes that the problems of capitalist modernity are due to the obstacles it places in the way of rationalization in the moral-practical sphere.

There are also three X's (at 2.1, 3.2, 1.3) on the chart which refer to non-rationalizable world relations. Two of these are of interest to us. 2.1 is the norm-conformative relation to the objective world, i.e. the fraternal relation to nature. Although he is not explicitly mentioned here, Marcuse is clearly consigned to box 2.1. Another X is placed over 3.2, the expressive relation to the social world, bohemianism, the counterculture, exactly where Marcuse and his allies in the New Left sought the alternative to modernity. In sum, the '60s are placed under X's in zones of irrationality which are incapable of contributing to the reform of a modern society. This figure explains more precisely than his early essay on "Technology and Science as 'Ideology'" why Habermas rejects Marcuse's most radical critique of technology.

How might Marcuse have replied? He could have drawn on the arguments against the neutrality of science and technology developed in his essay on "Industrialization and Capitalism in the Work of Max Weber" (1968) and in *One-Dimensional Man*. In Habermas as in Weber, scientific-technical rationality is non-social, neutral, and formal. By definition it excludes the social (which would be 1.2). It is neutral



because it represents a species-wide interest, a cognitive-instrumental interest which ignores the specific values of every subgroup of the human species. And it is formal as a result of the process of differentiation by which it abstracts itself from the various contents it mediates. In sum, science and technology are not essentially responsive to social interests or ideology but only to the objective world which they represent in terms of the possibilities of understanding and control.

Marcuse addresses this conception of the neutrality of the cognitive-instrumental sphere in his essay on Weber, where he shows that it is a special kind of ideological illusion. He concedes that technical principles can be formulated in abstraction from any content, that is to say, in abstraction from any interest or ideology. However, as such, they are merely abstractions. As soon as they enter reality, they take on a socially and historically specific content. Efficiency, to take a particularly important example, is defined formally as the ratio of inputs to outputs. This definition would apply in a communist or a capitalist society, or even in an Amazonian tribe. It seems, therefore, that efficiency transcends the particularity of the social. However, concretely, when one actually gets down to the business of applying the notion of efficiency, one must decide what kinds of things are possible inputs and outputs, who can offer and who acquire them and on what terms, what counts as waste and hazards, and so on. These are all socially specific, and so, therefore, is the concept of efficiency in any actual application. As a general rule, formally rational systems must be practically contextualized in order to be used at all. This is not merely a matter of classifying particular social contents under universal forms, but involves the very definition of those forms which, as soon as they are contextualized in a capitalist society, incorporate capitalist values.

This approach is a generalization from Marx's original critique of the market. Unlike many contemporary socialists, Marx did not deny that markets exhibit a rational order based on equal exchange. The problem with markets is not located at this level, but in their historical concretization in a form which

couples equal exchange to the relentless growth of capital at the expense of the rest of society. Economists might concede the bias of actual market societies, but they would attribute the difference between ideal models and vulgar realities to accidental "market imperfections." What they treat as a kind of external interference with the ideal-type of the capitalist market, Marx considers an essential feature of its operation. Markets in their perfect form are simply an abstraction from one or another concrete context in which they take on biases reflecting specific class interests.

Marcuse adopts a similar line in criticizing Weber's notion of administrative rationality, a fundamental aspect of rationalization. Administration in the economic domain presupposes the separation of workers from the means of production. That separation eventually shapes technological design as well. Although Weber calls capitalist management and technology rational without qualification, they are so only in a specific context where workers do not own their own tools. This social context biases Weber's concept of rationality however much he continues to talk about a universal process of rationalization. The resulting slippage between the abstract formulation of the category and its concrete social instantiation is ideological. Marcuse insists on the distinction between rationality in general and its historical realization in a concrete, socially specific rationalization process. "Pure" rationality is an abstraction from the life process of a historical subject. That process necessarily involves values that become integral to rationality as it is realized.

Habermas too finds Weber's rationalization theory equivocating between abstract categories and concrete instances, but his critique differs from Marcuse's. Habermas argues that behind the modern developmental process there lies a structure of rationality that is realized in specific forms privileged by the dominant society (see Chart 1 above). Weber overlooked systematic moments of potential normative rationalization suppressed by capitalism, and as a result confused the limits of capitalism with the limits of rationality as such.

Because Habermas does not challenge Weber's account of technical rationalization, he too appears to identify it with its specifically capitalist forms. Marcuse, on the contrary, attacks Weber's understanding of technical rationalization itself. Weber's error is not simply to identify one type of rationalization with rationalization in general, but more deeply to overlook the biasing of any and all rationality by social values. Weber's account of science and technology as non-social and neutral, which Habermas shares, masks the interests that preside over their original formulation and later applications. Hence Marcuse would consider even Habermas's ideal of across-the-board rationalization, including both technical and normative moments, to be value-laden.

I can imagine Habermas responding that these problems are mere sociological details inappropriate at the fundamental theoretical level. Raising them at that level might risk making a Trojan Horse of them for a romantic critique of rationality. The best way to keep the horse outside the city walls is to maintain a clear distinction between principle and application. Just as ethical principles must be applied if they are to enter reality, so must technical, economic or political principles. That the applications never correspond exactly to principles is not a serious objection to formulating the latter in purified ideal-types. At that essential level, there is no risk of confusion between formal properties of rationality as such and particular social interests.

This formalistic account of the relation of principle to application is more persuasive in ethics than in technology studies. Ethical principles formulated in abstraction from particular applications provide criteria for judging the latter. Even where the principles themselves require revision to remove deficiencies in their current formulation, the revision proceeds in the name of the principles. Thus a flawed understanding of equality is criticized from the standpoint of a more adequate understanding of equality. But the "principles" underlying technologies are instrumental rather than normative, and therefore can only correct instrumental deficiencies. The point of Marcuse's theory is to show that these

principles are insufficient by themselves to determine the contours of a specific technical form of life. For that, other factors must enter into the equation that have nothing to do with efficiency.

This theory is indeed a critique of rationality, but not a romantic regression to immediacy. Rather, it addresses the deceptive claims to neutrality that are made in the name of rationality. The point of criticizing this form of appearance is to bring technology under the judgment of normative principles, to raise its normative dimension to consciousness so that it can be discussed and challenged. There is no comparable problem in the application of moral principles because their biased implementation falls under the norm that is being applied. For example, if one invokes the principle of fairness selectively to perpetuate discrimination, as in the current attack on affirmative action, that is itself unfair. By contrast, technical changes introduced in the workplace to enhance managerial power may be justified by reference to efficiency, in the sense that they may increase the return on capital even as they render the job more difficult and painful. The moral dimension of this outcome is occluded rather than revealed by the application of technical norms.

Indeed, the use of technical alibis to justify what are in reality relations of force is a commonplace in our society. Typically, considerations of efficiency are invoked to remove issues from normative judgment and public discussion. The very formulation of moral norms is distorted where they are arbitrarily excluded from significant domains of life. Thus the failure of our society to judge work settings according to norms of democracy and respect for persons reacts back on our understanding of these norms themselves and renders them hollow and "formalistic" in the bad sense. The point then is that the neutrality thesis supports a different type of mystification than ethical formalism, one that may sometimes involve formalistic abuses but which in any case blocks public dialogue with technical alibis.

Marcuse's critique of science and technology was presented in a speculative context, but its major claim--the social character of rational systems--is a commonplace of recent constructivist research on science and technology. The notion of underdetermination is central to this approach (Pinch and Bijker, [1984]). If several purely technical solutions to a problem are available, with different effects on the distribution of power and wealth, then the choice between them is both technical and political. The political implications of the choice will be embodied in some sense in the technology.

Although he is not a constructivist, Langdon Winner (1986) offers a particularly clear illustration of the political implications of the underdetermination thesis. Robert Moses' plans for an early New York expressway included a height specification for overpasses that was a little too low for city buses. Poor people from Manhattan, who depended on bus transportation, were thereby prevented from visiting the beaches on Long Island. In this case a simple number on an engineering drawing contained a racial and class bias. We could show something similar with many other technologies, the assembly line for example, which exemplifies capitalist notions of control of the workforce. Reversing these biases would not return us to pure, neutral technology, but simply alter its valiative content in a direction less visible to us because more in accord with our own preferences.

Habermas himself at one time focused on this very phenomenon. In an early essay, he argued that science cannot help us decide between functionally equivalent technologies, but that values must intervene (Habermas, 1973: 270-271). He showed that the application of decision theory does not supply scientific criteria of choice, but merely introduces different valiative biases. Even in "Technology and Science as 'Ideology'" Habermas recognizes that "social interests still determine the direction, functions, and pace of technical progress" (Habermas, 1970: 105). He does not explain how this affirmation squares with his belief, expressed in the same essay, that technology is a "'project' of the

human species as a whole" (Habermas, 1970: 87). Even this (no doubt resolvable) inconsistency seems to disappear in the later work where technology is defined as non-social.

But surely the earlier position was correct. If this is true, then what Habermas calls the fraternal relation to nature, 2.1., should not have an X over it. If 1.1, that is, the objective relation to the objective world, is already social, the distinction between it and 2.1 is softened. Pure instrumentality is not opposed to social norms since all attitudes have a social dimension. Objectivity of the sort involved in natural scientific research would no doubt differ from the relation to nature which Marcuse recommends, but along a different axis from that identified by Habermas. The issue is not, as Habermas thinks, whether a teleological philosophy of nature makes sense today: it concerns our self-understanding as subjects of technical action.

This is the argument of Steven Vogel, who points out that Habermas's chart omits an obvious domain of normative relations to the objective world: the built environment. The question of what to build, and how to build it, engages us in normative judgments concerning factual states of affairs. While there is no science of such judgments, they are at least as capable of rationalization as the aesthetic judgements Habermas classifies under 3.1 on his chart (Vogel, 1996: 388). Here we can give a rational content to Marcuse's demand for a new relation to nature.

Nature would be treated as another subject where humans took responsibility for the well-being of the materials they transform in creating the built environment. There is nothing about this proposition that offends against the spirit of modern science. On the contrary, to carry out this program science is needed. Methodologically, the case is similar to medicine, which involves a normative relation to the objectified human body.

What is the result of this second phase of the debate? I think Marcuse wins this one. We are no longer in the new sobriety '80s, but have entered the social constructivist '90s, and his views sound much more

plausible than they did twenty or thirty years ago. However there are still problems with Marcuse's position. Even if Habermas's conception of technology falls under this constructivist counterattack, his rejection of romantic metaphysics stands. Rather than simply returning to Marcuse's original formulations, perhaps elements of his critical theory of technology can be reconstructed so that it no longer depends on a speculative basis. Does one really need a new science to get a Frank Lloyd Wright technology rather than a Mies van der Rohe technology? Couldn't one work toward such a transformation gradually, using existing technical principles but reforming them, modifying them, applying them somewhat differently? Environmentalism has shown us that this is a practical approach to a long-term process of technological change.

In the remainder of this paper I propose to reformulate the Marcusian design critique inside a version of Habermas's communication theory modified to include technology.

#### *IV. Reformulating the Media Theory*

Habermas's media theory provides the basis for a synthesis. This theory is designed to explain the emergence in modern societies of differentiated "subsystems" based on rational forms such as exchange, law, and administration. These "media" make it possible for individuals to coordinate their behavior while pursuing individual success in an instrumental attitude toward the world. Media-steered interaction is an alternative to coordinating social behavior through communicative understanding, through arriving at shared beliefs in the course of linguistically mediated exchanges. Roughly summarized, Habermas's aim is to right the balance between these two types of rational coordination, both of which are required by a complex modern society.

The media concept is generalized from monetary exchange along lines first proposed by Parsons. Habermas claims that only power resembles money closely enough to qualify as a full-fledged medium. Together, money and power "delinguistify" social life by organizing interaction through objectifying

behaviors. Common understandings and shared values play a diminished role on a market, because the market mechanism yields a mutually satisfactory result without discussion. Something similar goes on with the exercise of administrative power.

It is important not to exaggerate Habermas's concessions to systems theory.<sup>5</sup> In his formulation media do not eliminate communication altogether, merely the need for "communicative action". This term does not refer to the general faculty of using symbols to transmit beliefs and desires, but to the special form of communication in which subjects pursue mutual understanding (Habermas, 1984, 1987: I, 286). Media-related communication is quite different. It consists in highly simplified codes and stereotyped utterances or symbols which aim not at mutual understanding but at successful performance. Action coordination is an effect of the structure of the mediation rather than a conscious intention of the subjects.

This is the basis for the contrast that runs through *The Theory of Communicative Action* between system, media regulated rational institutions, and lifeworld, the sphere of everyday communicative interactions. The central pathology of modern societies is the colonization of lifeworld by system. The lifeworld contracts as the system expands into it and delinguistifies dimensions of social life which should be linguistically mediated. Habermas follows Luhmann in calling this the "technicization of the lifeworld".

The media theory allows Habermas to offer a much clearer explanation of the technocratic tendencies of modern societies than *Dialectic of Enlightenment* and *One-Dimensional Man*. His strategy here is the same as in his early critique of Marcuse: to limit the instrumental sphere, to bound it so that communicative action can play its proper role. But, surprisingly, even though he protests the "technicization" of the lifeworld, Habermas scarcely mentions technology. That seems to me an obvious oversight. Surely technology, too, organizes human action while minimizing the need for language.



There is a strong objection to this view, namely that technology involves causal relations to nature while the other media are essentially social. The codes that govern money and power are conventional, and possess communicative significance, however impoverished, whereas those that govern technology seem to lack communicative content. Or, put in another way, technology "relieves" physical, not communicative effort.

But in fact technology operates at both levels. It has several different types of communicative content. Some technologies, such as automobiles and desks, communicate the status of their owners (Forty, [1986]); others, such as locks, communicate legal obligations; most technologies also communicate through the interfaces by which they are manipulated. A computer program, for example, transmits the designer's conception of the problems to which the program is addressed while also helping to solve those problems (Suchman, [1987]). In any transportation system, technology can be found organizing large numbers of people without discussion; they need only follow the rules and the map. Again, workers in a well designed factory find their jobs almost automatically meshing because of the structure of the equipment and buildings--their action is coordinated--without much linguistic interaction.

Indeed, it is quite implausible to suggest as Habermas does, at least by implication, that one could completely describe action coordination in the rationalized spheres of social life simply by reference to money and power. Certainly no one in the field of management theory would subscribe to the view that a combination of monetary incentives and administrative rules suffices to coordinate economic activity. The problem of motivation is far more complex, and unless the technical rationality of the job brings workers together harmoniously in pursuit of the same goals, mere rules will be impotent to organize their activity.

To reduce technology to a mere causal function is to miss the results of a generation of research in the sociology of technology. By the same token, it would be a mistake to ignore the importance of a grasp of

causal mechanisms in the control of human behavior in the administrative sphere: the phrase "social technologies" is well chosen. But if one cannot reduce technology to natural causality, why exclude it from the list of media which it resembles in so many respects? Of course it is quite different from money, the paradigm medium, but if the loose analogy works for power, I would argue that it can be extended to technology as well. In Chart 2 (Habermas's figure 37), where Habermas defines money and power as media, I have listed technology alongside them and found a parallel for each of the terms he uses to describe them (1984, 1987: II, 274). I will not go over the whole chart, but will focus on three of the most important functions.

First, consider "generalized instrumental value". In the case of money it is utility, in the case of power it is effectiveness, and I call it productivity in the case of technology. Those in charge of technological choices (who are not necessarily technicians) interpose devices and associated behaviors between the members of the community which unburden them at both the communicative and the physical levels. This generates two types of value: first, the enhanced command of resources of the equipped and coordinated individuals, and second, the enhanced command of persons gained by those who mediate the technical process. This technical authority resembles political power but cannot be reduced to it. Nor is it as vague as influence or prestige, media suggested by Parsons which Habermas does not retain. I believe it is *sui generis*.

Second, each of these media makes a "nominal claim": with money it is exchange value, that is, money demands an equivalent; power yields binding decisions which demand obedience; and technology generates what I call, following Bruno Latour (1992), "prescriptions," rules of action which demand compliance. Complying with instructions in operating a machine is different both from obeying political commands and from accepting an exchange of equivalents on the market. It is characterized by its own unique code. The defining communication, the one which corresponds most closely to the simplified

codes of money (buy, not buy), and power (obey, disobey), is pragmatic rightness or wrongness or action.

Third, there is the sanction column, which Habermas calls the "reserve backing". In claiming that money is backed by gold Habermas skips twenty-five years of economic history, but of course monetary value must refer to something people have faith in. Power requires means of enforcement; in the case of technology, the natural consequences of error have a similar function, often mediated by organizational sanctions of some sort. If you refuse the technical norms, say, by driving on the wrong side of the street, you risk your life. You burden those who would have been relieved by your compliance and who must now waste time signalling to avoid a crash. Failing the success of this communicative intervention, nature takes its course and an accident enforces the rules encoded in law and in the technical configuration of highways and cars.

If technology is included in the media theory, the boundaries Habermas wants to draw around money and power can be extended to it as well. It certainly makes sense to argue that technical mediation is appropriate in some spheres and inappropriate in others, just as Habermas claims for money and power.

However, it has been objected that despite certain similarities to money and power, technology is so thoroughly intertwined with them, and with the lifeworld, that it defies a simple bounding strategy. It is better understood as a means or mediator by which the media penetrate the lifeworld, than as a medium in its own right. Technologizing a domain of life opens it to economic and political control; technology serves system expansion without itself being a medium.<sup>6</sup>

But is technology uniquely intertwined? This objection confuses two levels of the media theory. Habermas distinguishes the media as ideal-types, but in practice, of course, money and power are constantly intertwined. With money one can obtain power, with power one can obtain money; money is a means to power, power to money. Technology is no different. It can be distinguished from money and

power as an ideal-type with no difficulty, although empirically it is intertwined with them just as they are intertwined with each other. All media are mediations in this sense, all media serve as means for each other.

Historical considerations also argue for this view. In each phase or type of modern development, one or another of the media plays the mediating role, facilitating general system advance. Polanyi's description of the predatory market offers a model of market-led system expansion (Polanyi, [1957]). Foucault's discussion of the origins of the disciplinary society relies on the "capillary spread" of techniques (Foucault, [1977]). State power is the mediator for the extension of market and technical relations into traditional lifeworlds in most theories of Japanese and Russian modernization.

Juridification plays the mediating role in the contemporary welfare state according to The Theory of Communicative Action. Law, Habermas claims, is both a "complex medium" and an "institution". As a complex medium law appropriately regulates system functions. A society with contracts obviously needs laws and means of enforcement. But, as an institution, law also regulates lifeworld functions, for example through welfare and family legislation. To some extent that is necessary, but regulating the lifeworld can have pathological consequences: communication is blocked or bypassed, mistrust enters, and so on. Then law becomes an instrument of colonization of lifeworld by system.

In these respects technology offers an exact parallel to law. It, too, mediates both system and lifeworld functions. On this account, technical improvements in production would be unobjectionable. But the application of technology to lifeworld functions sometimes gives rise to pathologies. Consider, for example, the medical offensive against breast feeding in the 1930s and '40s. In this instance, an aspect of family life was technologized in the mistaken belief that formula was healthier than breast milk. This technical mediation complicated infant care unnecessarily while opening huge markets. The widespread use of formula in countries without pure water supplies spread infant diarrhea which in turn required

medical treatment, further intruding technology on infant care. This is a clearly pathological intervention of technology into the lifeworld.<sup>7</sup>

This section has suggested a way of developing a critical theory of technology on a communication-theoretic basis. Instead of ignoring the growing technologization of advanced societies, it can be subjected to analysis and critique. I hope that this approach will enable Critical Theory to resume the interrupted discussion of technology it pursued until the early debate between Marcuse and Habermas recounted above.

### *V. Value and Rationality*

This treatment of technology as a medium improves Habermas's theory of communicative action without shattering its framework. Nevertheless, it suggests some deeper problems in the theory which do place its framework under tension. I would like to address those problems in the concluding sections of this essay.

The synthesis sketched so far concerns only the extent and the range of instrumental mediation and not technological design. This is because Habermas's system theory offers no basis for criticizing the internal structure of any of the media. He can challenge their overextension into communicative domains but not their design in their own domain of competence. Nothing in his theory corresponds to Marcuse's critique of the neutrality thesis. But it is difficult to see how a critical theory of technology can avoid addressing questions of design. Is it possible to recapture the essential point of Marcuse's critique without defending the controversial metaphysical assumptions with which he supports it? I will argue that this goal can be achieved but only by abandoning both the specifics of Marcuse's quasi-Heideggerian approach and the notion of formal rationality which Habermas takes over from Weber.

What I am aiming at is a two-level critique of instrumentality. At one level I will follow Habermas and the critique of technology as such in claiming that the media have certain general characteristics which

qualify their application. This justifies the demand for boundaries on their range. But a second level critique is also needed because the design of the media is shaped by the hegemonic interests of the society they serve. Markets, administrations, technical devices have what I will call an implementation bias: the form in which they are realized embodies specific valuative choices. These designed-in biases leave a mark on the media, even in those domains where they appropriately regulate affairs. Therefore, critique must not cease at the boundary of the system but must extend deep inside it.

Is this two-level approach to the critique of the media consistent? Can critique at the second level be reconciled with Habermas's distinction between system and lifeworld? Blurring the boundary between the two appears to undermine the colonization thesis, diminishing the critical potential of the Habermasian theory. We can no longer protest against the extension of pure technological rationality into communicatively regulated domains if there is no fundamental difference between system and lifeworld in the first place.

This objection is related to the question of whether the system/lifeworld distinction is analytic or real. Axel Honneth (1991), among others, objects to Habermas's identification of the terms of this distinction with actual institutions, e.g. state, market, family, school. In reality there is no clear institutional line between system and lifeworld. Production as much as the family is constituted by a promiscuous mixture of cognitive, normative, and expressive codes, success-oriented and communicative action. The distinction is therefore purely analytic.

It seems to me that several different considerations are confused in these objections. Surely Habermas is right to argue that there is a fundamental difference between institutional contexts that are preponderantly shaped by markets or bureaucracies (and, I would add, technologies), and others in which personal relations or communicative interaction are primary. The fact of mixed motives and codes

notwithstanding, without some such distinction one can make no sense at all of the process of modernization.

The problem is not the distinction per se, but the identification of one of its terms with neutral formal rationality. Contemporary feminist theory, organizational sociology, and sociology of science and technology have abundantly demonstrated that no such rationality exists. For example, Nancy Fraser (1987) has shown that the high level of abstraction at which Habermas defines his categories only serves to mask their gendered realization in concrete societies. System and lifeworld, material production and symbolic reproduction, public and private, all such abstractions hide distinctions of male and female roles which invest even the apparently pure administrative and political rationality of the modern economy and state. Failing to grasp that fact leads to an overestimation of the centrality of the pathologies of colonization (reification), and a corresponding underestimation of the oppression of social groups such as women.

We need a way of talking about designed-in norms of the sort that characterize all rationalized institutions without losing the distinction between system and lifeworld. I propose to develop the concept of 'implementation bias' for this purpose. Implementation bias enters media in media-specific forms, not as communicative understandings of the sort that characterize the lifeworld. Latour (1992) calls this sort of bias delegation: norms are delegated to technology through the design and configuration of devices and systems. This notion can be generalized to the other media, so that one can talk about the delegation of norms to markets, laws, etc. The two forms of action-coordination Habermas identifies and the corresponding domains of system and lifeworld can thus be kept meaningfully separate without the need for an unconvincing notion of pure rationality.

However, so far as I can tell, this is not Latour's agenda. Rather than reconstruct the notion of rationality in this way, Latour and his colleagues seem to be trying to blur the line between rationality and everyday

practice. Like constructivist microsociology, they reduce the specificity of system functions to the lifeworld without regard for the macro-sociological consequences of system expansion in modern societies. Indeed, Latour (1991) has entitled one of his books *We Have Never Been Modern*. I believe this is an overreaction to the notion of pure rationality. Even in Latour's book, the "non-modern" sociologist finds it necessary to introduce substitutes for the system/lifeworld, modern/premodern distinctions (1991: 181ff). It is pointless to deny the differences, however "constructed" they may be, between rationalized operations such as modern technology makes possible, and non-technological modes of action. There is a point, however, to showing that despite the differences, the rationalized operations are still value-laden to the core.

Precisely how do normativity and system rationality co-exist in the media? The conundrum only appears so difficult because our conception of valuative bias is shaped by lifeworld contexts and experiences. We think of values as rooted in feelings or beliefs, as expressed or justified, as chosen or criticized. Values belong to the world of 'ought', in contrast to the factual world of 'is'. Of course, this common-sense notion of values overlooks the institutional realization of norms in an objectified background consensus which makes social life possible. Organizational sociology insists on this point, and Habermas agrees that rationalized activities require a shared normative background of some sort, for example, consensus on the meaning and worth of the activities. Yet the question goes deeper. We need to know how institutions based on system rationality realize objectified norms in devices and practices, and not merely in individual beliefs or shared assumptions.

A somewhat similar conceptual difficulty arises in relation to equitable treatment of racial or ethnic groups. A culturally biased test may be fairly administered and yet favor one group unfairly at the expense of another. In such cases the bias need not be present in the everyday form of prejudice, nor is it merely a background assumption of the testers. Rather, it is actually there in the test itself, and yet no



amount of study of the test and the testing conditions will reveal it since it is a relational property of the test in its social context.

I propose to call this sort of inequity a "formal bias", in contrast to the "substantive bias" that commonly appears in the lifeworld.<sup>8</sup> Formal bias is a consequence of the formal properties of the biased activity, not of substantive value choices. In the case of a culturally biased test, for example, the choice of testing language or supposedly familiar questions suffices to bias the outcome. There is no need for a substantive intervention such as underhanded downgrading of members of the minority group, or quotas excluding them from the positions to which the test gives access.

The concept of formal bias can be generalized to cover biases in the implementation of technically rational systems. Their internal workings may be exhaustively described without reference to values other than efficiency and cognitive correctness; however, their design reveals an implicit normative content when placed in its social context.

Critical theory has struggled to raise that content to consciousness ever since Marx's original critique of the neutrality of the market. Much that is obscure and challenging in Marx and in such radical Marxists as Marcuse stems from the complexity of that critique. I am not sure whether Habermas's theory of communicative action adequately reflects that complexity. The notion of a nonsocial instrumental rationality seems to put the critique out of action. Where technical designs embody normative biases that are taken for granted and placed beyond discussion, only a type of critique Habermas's theory excludes can open up a truly free dialogue.

In the case of technology, this critique is still largely undeveloped although some work has been done on the labor process, reproductive technologies, and the environment. The research seems to show that modern technological rationality exhibits fundamental deficiencies in its handling of labor, gender, and nature. These deficiencies are systematically related to the nature of our social order. They determine

the way in which we think about technical action and design technical devices. Social critique of these general deficiencies is therefore necessary.

It is true that this pattern is often condemned in totalizing critiques of technology as such. Habermas is right to want to avoid the technophobia sometimes associated with that approach. However, Marcuse's (1964) historicized critique identifies a similar pattern without foreclosing the possibility of future change in the structure of technological rationality. As we have seen, it is based on the quasi-Heideggerian distinction between technology as reduction to raw materials in the interest of control, and a differently designed technology that would free the inherent potential of its objects in harmony with human needs. We have already discussed some of the unsolved problems with this theory.

These problems do not, however, justify returning to an essentialist approach which defines technology in abstraction from any sociohistorical context. Nor will it work to claim, as Habermas would, that there is a level of technical rationality that is invariant regardless of changes in that context. While there is some core of attributes and functions that enables us to distinguish technical rationality from other relations to reality, he wants to get too much--a whole social critique--out of the few abstract properties belonging to that core. No doubt it includes, as he affirms, the objectifying, success-oriented relation to nature--but it must be embodied in technical disciplines that include much else besides to provide a basis for application. It is the rationality of those disciplines that is in question, since that is the concrete institutional form in which reason becomes historically active.

Is it possible to develop a critique of technical rationality at that institutional level while avoiding the pitfalls of Marcuse's theory? I believe this can be done through analysis of the reflexive properties of technical practice. This approach can capture something of Marcuse's contribution while also clarifying problems in Habermas's notion of rationality.

Admittedly, the claim that technology has reflexive properties is surprising. Yet if we are serious about saying that technology is essentially social, then like all social institutions it too must be characterized by its reflexivity. That this is not generally recognized is due to the identification of technology as such with a particular ideology hostile to reflection. Heidegger practically admits as much when he affirms that the essence of technology is nothing technological. Ellul too warns us off early on in his major work: the "technical phenomenon" is not so much a matter of devices as of the spirit in which they are appropriated. But in the end, these thinkers and their followers fail to develop an independent theory of technology. They seem to conclude that because technology harbors the evils they have identified in positivism, instrumentalism, behaviorism, mechanism, and all the other doctrines they so effectively criticize, the critique of the one can take the place of a theory of the other. Habermas is no different from these predecessors in this regard: his model of the technical relation to the world is positivism and takes over from that doctrine assumptions about the possibility of a nonsocial, neutral rationality. He identifies that ideology with the eternal essence of technology.

It is true that, abstractly conceived, technology does bear an elective affinity for positivism, but that is precisely because every element of reflexivity has been left behind in extracting its essence from history. The essence of technique in the broadest sense is not simply those constant distinguishing features identified in extra-historical conceptual constructions such as Habermas's. To be sure, such constructions can sometimes yield insight, but only into what I will call the "primary instrumentalization" that distinguishes technical action generally. Technique includes those features in historically evolving combinations with variable ones. Those few determinations shared by all types of technical practice are not an essence prior to history, but are merely abstractions from the various historically concrete essences of technique at its different stages of development, including its modern technological stage.

The reflexive properties of technique enable it to turn back on itself and its users as it is embedded in its social and natural context. I am thinking of such attributes as aesthetic forms, workgroup organization, vocational investments, and various relational properties of technical artifacts. I call these reflexive features of technique "secondary instrumentalizations"; their configuration characterizes distinct eras in the history of technical rationality.<sup>9</sup> The passage from craft to industrial production offers a clear example: productivity increased rapidly, a quantitative change of great significance at the level of the primary instrumentalization, but just as importantly, secondary instrumentalizations such as product design, management, and working life suffered a profound qualitative transformation. These transformations are not merely sociological accretions on a presocial relation to nature but are essential to industrialization considered precisely in its technical aspect.

This position appears more plausible by contrast with Habermas's as soon as one asks what he actually means by the essence of technology, i.e. the objectivating, success-oriented relation to nature. Is there enough substance to such a definition to imagine it implemented? Is it not rather an abstract classification so empty of content as to tolerate a wide range of realizations, including Marcuse's notion of relating to nature as to another subject? Unless, that is, one smuggles in a lot of historically specific content. That is the only way one can get from the excessively general concept of a success-oriented relation to nature to the specific assertion that technology necessarily excludes respect for nature along the lines Marcuse proposes. But this move repeats the very error of which Habermas accuses Weber, identifying rationality in general with a specific historical realization of it.

The essence of technology can only be the sum of all the major determinations it exhibits in its various stages of development. That sum is sufficiently rich and complex to embrace numerous possibilities through shifts of emphasis and exclusions. One might treat it as a structure or formal logic in very much the way Habermas treats the different types of rationalization (see Chart I). The various technical

rationalities that have appeared in the course of history would each be characterized by a formal bias associated with its specific configuration. A critical account of modern technical rationality could be developed on this basis with a view to constructive change rather than romantic retreat.

Can such an approach be reconciled with discourse ethics? It suggests the need for the type of demystifying critique Habermas endorsed in his earlier *Knowledge and Human Interests*. There Habermas was more willing than he is now to recognize the political nature of the systematic distortions of communication in our society which render most dialogue empty and useless. To the extent that a certain distribution of social power is rooted in the given technological rationality, which in turn forms the unquestioned horizon of discussion, no amount of debate can make much difference. But how can that horizon be subverted? What type of critique, based on what kinds of practical challenges to everyday forms of oppression in a technological society can make a difference? I doubt that Habermas's theory of communicative action has all the resources needed to answer these questions, so tied is it to an inadequate concept of technical rationality.<sup>10</sup>

## *VI. Conclusion*

In this essay I have presented the basis for a position which resolves major problems in both Marcuse and Habermas. Let me summarize it in a sentence. Technology is a medium in which instrumental action-coordination replaces communicative understanding through interest-biased designs. Simply put, sometimes technology is overextended, sometimes it is politically biased, sometimes it is both. Several different critical approaches are needed, depending on the case. This position involves neither a repudiation of science, nor a metaphysics, neither instrumentalism, nor claims to neutrality. It solves what I think are the chief problems in Marcuse and Habermas's theories of technology, and it offers the basis for radical critique.

Many of Habermas's significant advances are compatible with this enlargement of the media theory to include technology. Indeed, in recent writings, he has already taken a significant step toward what I would describe as a two-level critique of law. Habermas (1994: 124) distinguishes between the "pure" moral norms that describe "possible interactions between speaking and acting subjects in general", and legal norms that "refer to the network of interactions in a specific society". Because they are the concrete expression of a people at a particular time and place, committed to a particular conception of the good life, these latter must incorporate substantive values. But they do so in a legally salient manner, not in a way that would erase the distinction between law and politics. Habermas (1994: 124) concludes, "Every legal system is also the expression of a particular form of life and not merely a reflection of the universal content of basic rights". Is this not rather similar to the approach to technology proposed here? I have argued that every particular instantiation of technical principles is socially specific, just as Habermas claims of law. Both are open to criticism not only where they are inappropriately applied, but also for the defects of the form of life they embody.

On this account bounding the system is not enough; it must also be layered with demands corresponding to a publicly debated conception of the good life.<sup>11</sup> It is unclear how to do this in the original Habermasian media theory because of the lack of a concept of implementation bias, but it follows directly from the revision of the theory proposed here. Where technical design is layered with democratic demands, deep socio-technical changes are foreshadowed. We need a method that can appreciate these occasions, even if they are few and far between, even if we cannot predict their ultimate success. This essay has attempted to create a theoretical framework for doing precisely that.

One can only wonder why the problem of technology was not addressed earlier, on these or similar terms, in response to the desire of so many in the Frankfurt School tradition for a widening of the horizon of critique. Could it be that old disciplinary boundaries between the humanities and the sciences

have determined the fundamental categories of social theory? If so, it is time to challenge the effects of those boundaries in our field, which is condemned to violate them by the very nature of its object.

### *Endnotes*

1. This paper is based on a talk given at the TMV Centre of the University of Oslo and the Centre for the Study of the Sciences and the Humanities of the University of Bergen. The current version reflects discussion at those sessions, and with Torben Hviid Nielsen, Thomas Krogh, David Ingram, and Gerald Doppelt, to whom I am deeply grateful for many helpful criticisms.

2. I discuss a number of related issues in the interpretation of Habermas in Feenberg 1994.

3. For a fuller treatment of Marcuse's views, see Feenberg 1987.

4. This chart is the object of an interesting debate between Habermas and Thomas McCarthy. See Bernstein 1985: pp.177ff and 203ff. Habermas rather confuses the issues here by apologizing for using the chart to present his own views when in fact it was meant primarily as an explanation of Weber; but then he goes on to use it once again to present his own views. The debate is inconclusive since, as I will explain in more detail below, it poses the question of a normative relation to the objective world in terms of the possibility of a natural philosophy rather than in terms of a reconceived technical reason. Cf. also Thompson and Held 1982, pp. 238ff. Marcuse (1964: 166) was none too clear on what he intended, but at least he explicitly rejected regression to a "qualitative physics."

5. For a discussion of this issue, see McCarthy 1991 and Habermas's reply in Habermas 1991.

6. This objection has been suggested to me by Torben Hviid Nielsen and Thomas Krogh.

7. Before leaving this point, it is perhaps necessary to forestall a possible misunderstanding. It would be misleading to identify technology (or any of the other media) with instrumentality as such. If all instrumentality is designated as technological, one has no basis on which to distinguish between the

various media. Furthermore, one cannot distinguish the broad realm of technique in general from its specifically modern technological form. In particular, traditional craft, with its premodern technologies, and what might be called personal technique must be distinguished from modern technology, i.e. hand work and ordinary lifeworld activities carried out by individuals or small groups with small scale means under individual control, as opposed to unusually complex activities mediated by semi-automatic devices and systems under some sort of management control. No doubt the line is fuzzy, but this general distinction is useful and allows us to judge the degree of technicization of the lifeworld in Habermas's sense. This is clear from the example of breast feeding which is not without its own *techne*, different from formula but "success oriented" too. On these terms baby formula is modern technology and as such a mediation, unlike breast feeding which is a personal technique. The realm of technical action is thus broader than the realm of media.

8. For a fuller treatment of this concept see Feenberg 1991: chapter 8.

9. For a fuller treatment of this concept see Feenberg 1991: chapter 8. A very different alternative is represented by Lorenzo Simpson's *Technology, Time, and the Conversations of Modernity*. Simpson denies that he is essentializing technology, and yet he works throughout his book with a minimum set of invariant characteristics of technology as though they constituted a "thing" he could talk about independent of the socio-historical context (Simpson, 1995: 15-16, 182). That context is then consigned to a merely contingent level of influences or conditions rather than being integrated to the conception of technology itself.

10. For an interesting attempt to defend discourse ethics by enlarging its scope to include technical relations, see Ingram 1995, Chap. 5.

11. For more on the concept of layering, see Feenberg 1995, especially chap. 9.



## *References*

Adorno, Theodor and Horkheimer, Max (1972). *Dialectic of Enlightenment*. J. Cummings, trans. New York: Herder and Herder.

Bernstein, Richard, ed. (1985). *Habermas and Modernity*. Cambridge: Polity Press.

Braverman, Harry (1974). *Labor and Monopoly Capital*. New York: Monthly Review.

Bijker, Wiebe, Hughes, Thomas, and Pinch, Trevor, eds. (1989). *The Social Construction of Technological Systems*. Cambridge, MA: MIT Press.

Commoner, Barry (1971). *The Closing Circle*. New York: Bantam.

Dreyfus, Hubert (1995). "Heidegger on Gaining a Free Relation to Technology," in *Technology and the Politics of Knowledge*, A. Feenberg and A. Hannay, eds. Bloomington and Indianapolis: Indiana University Press.

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

Feenberg, Andrew (1987), "The Bias of Technology," in *Marcuse: Critical Theory and the Promise of Utopia*, R. Pippin, A. Feenberg, C. Webel, eds. South Hadley, Mass.: Bergin & Garvey Press.

Feenberg, Andrew (1991). *Critical Theory of Technology*. New York: Oxford Univ. Press.

Feenberg, Andrew (1994). "The Technocracy Thesis Revisited: On The Critique of Power," *Inquiry*, vol. 37. no. 1

Feenberg, Andrew (1995). *Alternative Modernity: The Technical Turn in Philosophy and Social Theory*. Los Angeles: Univ. of California Press.

Forty, Adrian (1986). *Objects of Desire*. New York: Pantheon.

Foucault, Michel (1977). *Discipline and Punish*, A. Sheridan, trans. New York: Pantheon.

Fraser, Nancy (1987). "What's Critical about Critical Theory," in *Feminism As Critique*, S. Benhabib and D. Cornell, eds. Cambridge, Eng.: Polity Press.

Habermas, Jürgen (1970). "Technology and Science as 'Ideology'," in *Toward a Rational Society*, J. Shapiro, trans. Boston: Beacon Press.

Habermas, Jürgen (1973). "Dogmatism, Reason, and Decision: On Theory and Praxis in our Scientific Civilization," in *Theory and Practice*, J. Viertel, trans. Boston: Beacon Press.

Habermas, Jürgen (1984, 1987). *Theory of Communicative Action*, 2 vols., T. McCarthy, trans. Boston: Beacon Press.

Habermas, Jürgen (1991). "A Reply," in *Communicative Action*, A. Honneth., and H. Joas. eds., J. Gaines and D. Jones, trans. Cambridge, Mass.: MIT Press.

Habermas, Jürgen (1994). "Struggles for Recognition in the Democratic Constitutional State," in *Multiculturalism*, A. Gutman, ed. Princeton: Princeton Univ. Press.

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

Hirschhorn, Larry (1984). *Beyond Mechanization: Work and Technology in a Postindustrial Age*. Cambridge, Mass.: MIT.

Honneth, Axel (1991). *The Critique of Power: Reflective Stages in a Critical Social Social Theory*, K. Baynes, trans. Cambridge, Mass.: MIT Press.

Ingram, David (1995). *Reason, History, and Politics: the Communitarian Grounds of Legitimation in the Modern Age*. Albany: State University of New York Press.

Latour, Bruno (1992). "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts," in *Shaping Technology/Building Society: Studies in Sociotechnical Change*, W. Bijker, and J. Law, eds. Cambridge, Mass.: MIT Press.

Latour, Bruno (1991). *Nous n'avons jamais été modernes*. Paris: La Découverte.

Marcuse, Herbert (1964). *One-Dimensional Man*. Boston: Beacon Press.

Marcuse, Herbert (1968). "Industrialization and Capitalism in the Work of Max Weber," in *Negations*, J. Shapiro, trans. Boston: Beacon Press.

Marcuse, Herbert (1969). *An Essay on Liberation*. Boston: Beacon Press.

McCarthy, Thomas (1991). "Complexity and Democracy: or the Seductions of Systems Theory," in *Communicative Action*, A. Honneth, and H. Joas eds., J. Gaines and D. Jones, trans. Cambridge, Mass.: MIT Press.

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

Polanyi, Karl (1957). *The Great Transformation*. Boston: Beacon Press.

Pinch, Trevor and Bijker, Wiebe (1984). "The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science*, no. 14.

Simpson, Lorenzo (1995). *Technology, Time, and the Conversations of Modernity*. New York: Routledge.

Suchman, Lucy (1987). *Plans and Situated Actions: The Problem of Human-Machine Communication*. Cambridge, England: Cambridge Univ. Press.

Thompson, John B. and Held, David, eds. (1982). *Habermas: Critical Debates*. Cambridge, Mass.: MIT Press.

Vogel, Steven (1995). *Against Nature: The Concept of Nature in Critical Theory*, Albany: SUNY Press, forthcoming, 1996.

Winner, Langdon (1986). "Do Artifacts Have Politics," in *The Whale and the Reactor*. Chicago: Univ. of Chicago.

White, Lynn (1972). "The Historical Roots of Our Ecological Crisis," in *Philosophy and Technology: Readings in the Philosophical Problems of Technology*, C. Mitcham and R. Mackey, eds. New York: The Free Press.