Introduction

Given the interconnections between particular technologies and local/global problems such as war, poverty, environmental destruction, disease, and increasing economic disparity, the importance of formulating a theory of technological transformation seems paramount. To this end, Andrew Feenberg offers one of the most fully developed theories on the politics of technological transformation to date.[1] His critical theory of technology is, therefore, a significant point of dialogue for further research, hence the reason for this volume.

Feenberg argues that "there are ways of rationalizing society that democratize rather than centralize control."[2] He reasons that if modernity as we know it is established through a process of rationalization, then alternative rationalizations are necessary in order to create alternative modernities. According to Feenberg, the current modernity is characterized by a particular rationality—a technical code—and that this rationality has been embodied in the technological designs of modern society. Democratizing technology means expanding technological design to include alternative interests and values.

Background and Context of Feenberg's Work

Some understanding of the context of Feenberg's work is necessary to fully appreciate the contributions in this volume. Feenberg, a student of Herbert Marcuse, draws most heavily from the Frankfurt School[3] tradition to formulate his critical theory of technology. Like his Frankfurt School predecessors, Feenberg's work is largely a response to, or continuation, of Max Weber's theory of modernity. Weber claimed that the process of modernization fueled by capitalism's emphasis on "formal rationality" necessarily led to a differentiation

between technological and social spheres.[4] In short, the progress of modernity was achieved at the expense of moving away from the personal (substantive) relations of traditional societies to the impersonal (formal) relations of modern society. According to Weber, capitalism adopts formal rationality to achieve increased control, the end of which is total bureaucracy—the "iron cage."[5] Driven by human needs, capitalism attempts to maximize production through formal rationality. The more rationalized a system becomes the more it produces. End of story. There cannot be a normative assessment of such a value-neutral system.

The degree to which Frankfurt Institute members[6] borrowed from the work of Weber cannot be overemphasized. Like Weber, Theodore Adorno and Max Horkheimer held that in the context of capitalism "useful" translates into economically valuable.[7] Although the drive for domination was not new to the Enlightenment, it was the employment of new tools of domination—science and technology—that made the Enlightenment program unique. Technology as instrumental reason was one of the primary means of instilling this domination.[8] Reason was therefore not the road to emancipation hailed by Enlightenment thinkers, but a new method of shackling humanity.

Herbert Marcuse elaborated these themes in his characterization of a "one-dimensional society."[9] According to Marcuse, technology has been co-opted through a political choice to establish the present form—"technological rationality." He argues that reason manifested through technology serves as an instrument of domination: "Today, domination perpetuates itself and extends itself not only through technology, but as technology. . . . Technological rationality thus protects rather than cancels the legitimacy of domination."[10]

Marcuse claims that the discourse of rationality established and maintained by the mass media, essentially negates all opposition. The discourse loses its play, dialogue, mediation, and consequently its ability to create new alternatives. It becomes tautologous, and in doing so it contains those aspects of the discourse that could offer an alternative to the status quo. It has, in Marcuse's words, created a one-dimensional society: "There is only one dimension, and it is everywhere and in all forms."[11] Class consciousness attained in the context of late capitalism is necessarily a false consciousness, "and this false consciousness has become embodied in the prevailing technical apparatus, which in turn reproduces it."[12] In the one-dimensional society, whatever "is" is right, and wrong is only that which is antithetical to the whole—the one-totalizing, all-pervading, self-legitimating discourse of truth.

Although Marcuse was skeptical about the prospects for transformation, he did believe that it was possible. His proposal for liberation involves three elements: a critique of the existing technological consciousness, a new subject, or agent, and a new technique of pacification. He claims that the contradictions created by the hyperrational, technological society open the door for critique.

This is not a belief in the inherent breakdown of economic conditions, as scientific Marxists argued. Marcuse, instead, argues that late capitalism generates enough negative externalities to make us question the rational nature of the given technological society. This is where critical theory comes in; it "strives to define the irrational character of the established rationality."[13]

Marcuse claims that the choice of an alternative technology is limited by: (1) the "stuff" of Nature, however defined, as it confronts the subjective interpreter, and (2) the form of interpretation in a given cultural historical context.[14] In other words, both the inherited technological (material) context and the given technological consciousness represent important constraints on technological choice. Alternative historical projects must be at least imaginable for the possibility of "an ingression of liberty into historical necessity."[15] Alternatives, however, are difficult to achieve because of the hegemony of the few who have control over the productive process.

The issue of agency is crucial; someone must be capable of acting. Although not particularly hopeful, Marcuse argues that the best opportunity for alternatives lies with the excluded, or marginalized. That is, the revolutionary standpoint rests with the outsiders and outcasts, such as people of color, the persecuted, and the unemployed. All they need is the consciousness to act.[16]

Although it is a given that Nature must be pacified for human existence, this mastery can be either repressive, or liberatory. Marcuse suggests a new "technique of pacification" to replace the established technology of domination. To accomplish this, Marcuse claims that technology must be redefined as an "art of life."[17] He sees the development of the aesthetic dimension as central to this liberation project.[18] Beauty must become a form of freedom. "Rather than being the handmaiden of the established apparatus, beautifying its business and its misery, art would become a technique for destroying this business and this misery."[19] And with the emancipation of Nature comes the simultaneous emancipation of human senses. We are thereby liberated to experience gratification from Nature in a multitude of new ways. Humans, however, must begin to appreciate Nature for its own sake—"a subject with which to live in a common human universe."[20]

Jürgen Habermas, a second-generation critical theorist, fundamentally opposes Marcuse's call for a new technology. According to Habermas, technology is essentially the unburdening of needs that are rooted in human nature through purposive-rational action (i.e., work).[21] Technology is who we are—the innate faculty of "purposive-rational action" enabled humans to control their environment and set themselves apart from the rest of Nature. For Habermas, suggesting a new technology is as absurd as suggesting a new human species. Liberation cannot be achieved by transforming technology because technology simply cannot be altered.

Habermas admits that the technological rationalization of society is problematic but that technology itself is not the cause. The source of the trouble lies in the tension between the spheres of work and communication. The domination of work, or purposive-rational action, over traditional forms of communication is a defining feature of the modern period.[22] Habermas claims that Marcuse is misguided in his call for a revision of the human-Nature relationship with an alternative mediating technology. Marcuse, according to Habermas, fails to distinguish between two different types of action. The human-Nature relationship is necessarily governed by "purposive-rational action." What Marcuse is advocating, on the other hand, is actually "communicative action."[23]

Like Weber (and the Frankfurt School), Habermas sees technology as instrumental rationality; specifically, he defines technology as "scientifically rationalized control of objectified process."[24] However, his approach to resolving the problem is somewhat different: "*Rationalization at the level of the institutional framework* can occur only in the medium of symbolic interaction itself, that is, through *removing restrictions on communication*."[25] Emancipation is therefore achieved not through a new technology as Marcuse advocates but by limiting purposive-rational subsystems through "new zones of conflict."[26] The central problem is not technology itself because, again, technology cannot be changed.

Feenberg's Critical Theory of Technology

With Weber as a backdrop, Feenberg combines the insights of Marcuse and Habermas to arrive at his own "critical theory of technology." He believes Marcuse was correct to argue that technology is to a large extent socially shaped and that the form of technology is a political choice. The problem with Marcuse's perspective is that he does not acknowledge the contingency within the technologically dominated one-dimensional society. For Marcuse, it is either all or nothing—a technique of domination or a technique of liberation. This is what leads Marcuse to argue that transformation must come from "outside" the system; those within the one-dimensional society are simply too constrained to act. Feenberg rejects this appeal to outsiders as the basis for transforming society. He argues that the goal is "not to destroy the system by which we are enframed but to alter its direction of development through a new kind of technological politics."[27] The aim, in other words, is to steer the system from within through subtle hybridizations not mass revolution.

With modifications, Feenberg employs Habermas's model of a democratic speech community as the means for liberating technological design choice from hegemonic constraints.[28] Whereas Habermas argues for the exclusion of technological rationality from the lifeworld of communicative action, Feenberg

brings rationality into Habermas's vision of a democratic community to arrive at his suggested "democratic rationality." Contra Habermas, this process of transforming technology must take place within the social.[29] The possibility exists to choose rationally more liberating technological designs that further the various interests of the community of actors. As Feenberg states, "There are ways of rationalizing society that democratize rather than centralize control."[30]

Although Feenberg draws heavily from Marcuse and Habermas to formulate his critical theory of technology, he attempts to eliminate their essentialist base.[31] Feenberg claims that the tendency to essentialize is due primarily to an overemphasis on the meta-level of culture. In the case of Habermas, this resulted from his sidelining of the technology-society relationship to focus on language and communication. This is even more obvious in the case of the Frankfurt Schoolers, such as Marcuse, who framed technology as an autonomous, rationalizing force acting hand-in-hand with capitalism to produce agentless workers/citizens of a one-dimensional society. Their infatuation with Weber's concept of rationalization, combined with the philosophical shift in Marxism,[32] predisposed the Frankfurt School to focus on consciousness, or ideology.

Feenberg's central point is that technology can only be misconstrued as an autonomous-rationalizing force if the contingency evidenced at the micro-level of design is ignored. Although technology frequently appears to have an essence because it is viewed ahistorically, there is actually no "essence" of technology. Feenberg argues that scholarly interpretations of the social construction of technology (SCOT)[33] establish convincingly that technical design can only be defined contextually and locally by the particular technology-society relationship.[34] There is a significant degree of contingency, difference, or, "interpretive flexibility" in a society's relationship with particular technologies.

While SCOT reveals insight on the technology-society relationship, Feenberg rightly points out its deficiencies. SCOT is too narrowly focused on the development of particular technological artifacts, or systems.[35] Wanting to include all elements in the analysis is understandable; however, SCOT takes the concept of symmetry[36] too far in an attempt to level the playing field. SCOT ignores the larger issue of how particular design choices are made over other choices, which, as Feenberg argues, is an inherently political question. He claims that since technology can never be removed from a context, it can never be neutral.[37] Technological design is inherently political; consequently, the observed constraint on design choice is not some essence of technology but evidence of the hegemonic control of the design process by privileged actors.

There is, however, an obvious tension between the *contingency* observed at the level of design choice, and the *constraints* placed on design by the larger cultural-political milieu. Feenberg characterizes this tension as the "ambivalence" of technology, which he conveys in the following two principles:

1. *Conservation of hierarchy:* social hierarchy can generally be preserved and reproduced as new technology is introduced. This principle explains the extraordinary continuity of power in advanced capitalist societies over the last several generations, made possible by technocratic strategies of modernization despite enormous technical changes.
2. *Democratic rationalization:* new technology can also be used to undermine the existing social hierarchy or to force it to meet needs it has ignored. This principle explains the technical initiatives that often accompany the structural reforms pursued by union, environmental, and other social movements.[38]

Feenberg admits that advanced societies concretize power through technologically mediated organizations that prevent their citizens from meaningful political participation. Focusing on this aspect of culture led the Frankfurt School to characterize technology as an autonomous, rationalizing force. The problem is that they ignored the existence of the second principle of "democratic rationalization." Feenberg believes that democratic rationalization can overthrow this entrenched power "from 'within,' by individuals immediately engaged in technically mediated activities and able to actualize ambivalent potentialities suppressed by the prevailing technological rationality."[39]

He claims that "strategic" actors are able to realize their particular biases in to the technological designs. These biases stem from

> aspects of technological regimes which can best be interpreted as direct reflections of significant social values in the "technical code" of the technology. *Technical codes define the objects in strictly technical terms in accordance with the social meaning it has acquired.* These codes are usually invisible because, like culture itself, they appear self-evident.[40]

According to Feenberg, control over design choice is not always economically motivated, as Marxists frequently argue. That is, the utilitarian efficiency of the market is not always the motivating factor. Frequently, the aim is to either de-skill workers, or for management to maintain operational autonomy.[41] A centralized-hierarchical power structure is perpetuated because technological designs (codes) are intentionally chosen to maintain operational autonomy. Feenberg therefore admits that although technocratic power is foundationless and contingent, it nevertheless has a "unidirectional tendency."[42]

Despite this fact, Feenberg believes that it is possible for "tactical" actors to subvert the established technical code through their own democratic rationalizations. Feenberg provides examples of what he considers successful democratic

rationalizations of technology, such as the struggle over the Internet and AIDS activists' reform of the FDA drug approval process. Although the Internet was originally designed for the transmission of data, interpretive flexibility enabled a multitude of users to shape the Internet for their own uses.[43] In the case of AIDS treatment, activists collectively challenged traditional medicine's technocratic view of treatment. Activists forced a dialogue with research scientists and the FDA. In the end, they successfully altered the entrenched government bureaucracy to gain access to experimental medicines, which in turn led to significant advancements in treating AIDS.[44]

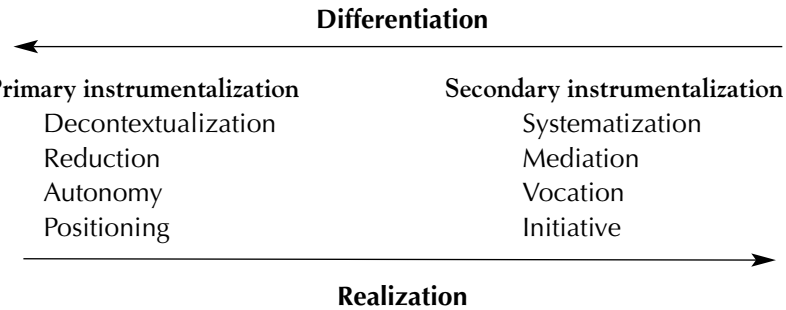
Instrumentalization Theory

The tensions between the principles of the "conservation of hierarchy" and "democratic rationalization" can also be discussed in terms of an *analytic* distinction between primary and secondary instrumentalization. Feenberg differentiates "primary instrumentalization" in which the functional, reifying aspects of technology are emphasized, from "secondary instrumentalization" where objects are constituted into their particular social contexts. Primary instrumentalization is therefore analogous to Weber's (and the Frankfurt School's) discussion of technology as formal rationality. Habermas, in agreement with Weber, sees differentiation (i.e., between technological and social spheres) as the unavoidable consequence of technological modernization. Feenberg in contrast argues that this differentiation is more apparent than real. That is, looking at technology at the meta-level makes it appear that technology has a differentiating effect.

He characterizes primary instrumentalization with four moments. Technology has the effect of *decontextualizing* entities from their original context. The qualities of objects are *reduced* to quantifiable terms so that they can be easily controlled with the established laws of science and technology. Those in control seek to *position* themselves strategically in order to more easily exert their power. All of this assumes a degree of *autonomization*, or distancing, between those in control and the objects being controlled.[45]

Feenberg suggests that primary instrumentalization and the process of differentiation can be overcome not through containment, as Habermas argues, but through a process of subversive, or secondary, instrumentalization. The overall thrust of this level is to *realize* elements that have been decontextualized through the process of primary instrumentalization. Feenberg offers four secondary moments to counter the reifying moments of primary instrumentalization. Actors must seek to *systematize* elements that have been decontextualized.[46]

Figure 1. Feenberg's Theory of Instrumentalization[47]



In response to the reductionism of primary instrumentalization, actors can reinstill objects with secondary qualities. Aesthetic and ethical *mediations* are added to technological objects when recontextualized. Autonomization can be overcome through *vocation*, or the actual way in which users engage technologies. Although the distancing effect of technology is real, actors can make choices in the way in which they actually employ technologies. Finally, tactical actors can exert their *initiative* to counter the positioning of strategic actors attempting to control them through technology.[48]

Technological Consciousness

In order to move toward realization, the hegemony constraining design choice must be exposed. What is needed, according Feenberg, is a theory of cultural change: "A new culture is needed to shift patterns of investment and consumption and to open up the imagination to technical advances that transform the horizon of economic action."[49] He draws on a number of intellectual traditions—hermeneutics from Heidegger, cultural theory from Foucault and Baudrillard, and critical theory—to reveal how the interests of certain actors achieve and maintain control of the design choice process.

Feenberg argues that the essentialist view of technology as inherently differentiating is actually a product of a reified technological consciousness. He compares this consciousness to Marx's discussion of commodity fetishism[50] in which commodities are reified and treated as actually existing, autonomous entities:

> The fetishistic perception of technology similarly masks its relational character: it appears as a non-social instantiation of pure technical rationality rather than as a node in a social network. Essentialism theorizes this form and not the reality of technology.[51]

The technological consciousness reifies the split between primary (functional) and secondary (all other) qualities. Feenberg, however, argues that this division follows from modern society's exaggerated emphasis on functionality. In its extreme form this begins to look much like modernity's hyperrationalization of society through capitalism's emphasis on utilitarian efficiency. It is possible to describe technological objects using both functional and social language, which is what Feenberg means by contrasting the moments of primary and secondary instrumentalization. But again, it must be understood that this is an analytic distinction and that only part of the secondary instrumentalization can be considered social.[52]

Organization of Volume

Contributors to this volume both critique and build on Feenberg's efforts to establish a theory of technological reform. Although there is no clear way of segregating the articles, they do fall roughly into two groups. Chapters in Part 1 center loosely on Feenberg's theoretical assumptions. The chapters in Part 2, on the other hand, focus more on the politics of technological reform. Regardless, the division is not simply between theory and practice as both parts contain elements of each.

In the first chapter, David Stump takes issue with Feenberg's use of the social construction of technology (SCOT). Stump claims that SCOT is itself essentialist in that it makes a priori assumptions about the design process. In short, SCOT is too narrowly focused on the social, or political aspects of technological design. Placing too much emphasis on the social aspects is what leads to Feenberg's overly optimistic picture of technological transformation. Taking all factors into consideration, one may conclude that many entrenched technologies are extremely difficult to alter.

In addition, Stump argues that Feenberg's critical theory of technology is also essentialist because it relies on a notion of "technology in general." The problem is that there is a tension between providing a normative approach to technological transformation and avoiding essentialism. Stump, however, suggests that it is possible to adopt an anti-essentialist approach by making generalizations from the historical analysis of particular technologies and then applying these generalizations normatively.

In chapter 2, Simon Cooper challenges Feenberg's theoretical approach with a discussion of the "ontological contradictions" created by emerging biotechnologies. These technologies have the potential of simultaneously enhancing our lives, and destroying our contexts of meaning. According to Cooper, biotechnologies are creating a "posthuman" future categorically

different than any suggested by Feenberg's "alternative modernities." Cooper argues that Feenberg's theory of transformation is too dependant on established cultural reference points (e.g., democratic norms), which will radically change in a posthuman world. Cooper argues that we must ask broader questions to effectively engage these emerging technologies.

Trish Glazebrook (chapter 3) approaches Feenberg's work as a Heideggerian ecofeminist. She is excited about the prospects of linking her work with the specifics of Feenberg's politics of technological transformation. More constructive, rather than critical, Glazebrook establishes a number of connections between ecofeminism and Feenberg's politics of technology. First, technology and women's bodies are both sites of political struggle and resistance. Second, Feenberg's constructivist view of technology resonates with the prevailing feminist view of gender as constructed. Third, Feenberg's concept of "subversive rationalization" offers a powerful reply to those who persist in labeling feminists as "anti-rationalists."

Glazebrook, however, objects to Feenberg's critique of Heidegger. She argues that Feenberg is more Heideggarian than he admits, and that he also displays essentialist tendencies in his discussion of instrumentalization. Glazebrook argues that the Heideggerian perspective on technology as "ways of thinking" is still useful. In addition to our actual practice, we need a theoretical/ideological shift in the way we engage technology.

In chapter 4, Iain Thomson takes issue with Feenberg's framing of Heidegger as a technological essentialist. Thomson claims that Feenberg's critique of Heidegger's essentialism can be broken into three types: ahistoricism, substantivism, and one-dimensionalism, and then proceeds to show how none of these critiques actually apply to Heidegger's views. Thomson hopes that his analysis will "vindicate Heidegger's ground-breaking ontological approach to the philosophy of technology," and "help to orient the approach of future philosophers of technology to one of its central theoretical controversies" (i.e., essentialism).

In the fifth chapter, Larry Hickman spins a pragmatist's web around Feenberg's work and claims that John Dewey anticipated much of his theory of technology by several decades. Most notably, Dewey's theory of technoscience, like Feenberg's, was anti-essentialist, constructivist, and democratic in nature. But in addition, Hickman claims that Dewey's theory is more developed than Feenberg's because he offers a detailed theory of democracy which Feenberg does not.

Part 2 begins with a chapter by Gerald Doppelt who sees Feenberg's project as two distinct parts—the first deals with the demystification of old theories of technology, and the second a new normative, critical theory of technology. Doppelt is convinced by Feenberg's critique of essentialist theories of

technology; however, he does not believe that Feenberg supplies the necessary "ethical resources" for his "democratic rationalization of technology." He agrees with Feenberg's claim that the potential exists for marginalized interests to shape the design process—Feenberg's examples establish this. However, Doppelt asserts that the notion of "participant interests" is inadequate to supply a conception of what a "democratized" technology actually is, or should look like. In other words, Doppelt believes that it is not sufficient to simply open up the design process to other interests; there must be some way of asserting *which* interests are better, or more democratic than others. Doppelt argues that Feenberg's critical theory must be supplemented with liberal-democratic concepts such as "entitlements" and "equality" to achieve this grounding.

In chapter 7, Albert Borgmann uses Feenberg as a platform to discuss the criteria of technological reform. He believes that Feenberg's theory meets the criteria of feasibility, cultural depth, scope, and substantive content. Borgmann points out, however, that Feenberg's own examples indicate that there is a limit to the democratization of technology. That is, the costs involved in extending secondary instrumentalization all the way down can be excessive. In addition, Borgmann believes that Feenberg fails to address two important hindrances to reform: (1) the fact that the majority of people choose affluence over autonomy, and (2) the enormous cost in terms of time and money that is required to effectively engage technology. Borgmann offers examples to illustrate these points and suggests avenues for future research that could lead to overcoming these obstacles.

Paul B. Thompson (chapter 8) suggests ways of extending Feenberg's theory of instrumentalization by borrowing from the field of institutional economics and the philosophy of Albert Borgmann. Thompson makes the important distinction between "structural" commodification and "technological" commodification. Structural commodification involves changes in the rules, laws, or social customs associated with a particular technology. In these instances, the actual physical technology itself is not altered.

In the case of technological commodification, the technological artifact itself is altered. The four parameters of alienability, excludability, rivalry, and standardization are actually built into the technological design. Thompson offers the invention of sound recording as an example of this type of commodification. He explains that "the advantages of the new vocabulary are an increased capacity to map the complexities of commodification and decommodification, and in a clearer way to express how technology and technological innovation affects those processes." Thompson concludes by illustrating the merits of his suggested vocabulary through a reexamination Feenberg's examples of AIDS activism and the Internet.

In the penultimate chapter, Andrew Light addresses Feenberg's views on environmentalism. He begins by criticizing Feenberg's assessment of the Erlich-Commoner debate over population,[53] arguing that this debate does not provide an accurate terrain of contemporary environmentalism. Light believes that environmentalism, and its relationship with technology, is far more complex than Feenberg insinuates. The issue of justice, according to Light, offers a better lens through which to analyze contemporary environmentalism.

Light also takes issue with Feenberg's suggested appropriation of environmentalism for the democratic reform of technology. Feenberg asserts that environmentalist's values can provide the catalyst and guide for the democratic reform of non-sustainable technologies. Light claims that Feenberg creates a black box out of environmentalism and uses it as a means to his end. As an alternative, Light wants to emphasize environmental management *practices*, and offers restoration ecology as an illustration. Restoration ecology is a technology that has the potential of facilitating the development of values conducive to the long-term establishment of sustainable communities. In other words, it is the practice or process that is important and not simply the values going into the process as Feenberg seems to suggest.

Ned Woodhouse, in the final chapter, largely agrees with Feenberg's project. His criticisms center around Feenberg's approach and the examples he uses to make his argument. Like Feenberg, Woodhouse agrees that technology is inherently contingent and malleable. However, Woodhouse believes that Feenberg's examples (e.g., AIDS activism) do not go the heart of contemporary society. Woodhouse suggests that movements such as "green chemistry" offer greater potential for change.

In terms of approach to reform, Woodhouse argues that Feenberg's methodology is too large in scope. He claims that Feenberg's project implies a wholesale replacement of our political and economic system (i.e., with socialism). Woodhouse, on the other hand, wants to take a more piecemeal approach by focusing on particular "elements of technological governance." He offers corporate executive officer incentive programs as one possibility for accomplishing this goal.

Feenberg concludes the volume with a reply to the contributors. His response is insightful because he attempts to situate their arguments within the broader context of his theory and the problems confronting technological reform in general. Clearly, there are gaps between the contributors' views and Feenberg's. The aim of this volume is to facilitate further dialogue and fill in the sketch provided by Feenberg's foundational work. Hopefully, others will be inspired to continue the important project of constructing an "alternative modernity."

Notes

1. Feenberg has written a trilogy of books and numerous articles on the subject. See Andrew Feenberg, *Critical Theory of Technology* (New York: Oxford University Press, 1991); Feenberg, *Alternative Modernity: The Technical Turn in Philosophy and Social Theory* (Los Angeles: University of California Press, 1995); Feenberg, *Questioning Technology* (London and New York: Routledge. 1999).
2. Feenberg, *Questioning Technology,* 76.
3. What has come to be known as the Frankfurt School of critical theory originated in the Institute for Social Research (Institute) as part of the Frankfurt Institute in 1923.
4. Max Weber, *Economy and Society: An Outline of Interpretive Sociology,* 3 vols., ed. Guenther Roth and Claus Wittich (New York: Bedminster Press, 1968).
5. Herbert Marcuse, *Negations: Essays in Critical Theory,* trans. Jeremy J. Shapiro (Boston: Beacon Press, 1968), 203.
6. Key members of the Institute included Max Horkheimer, Herbert Marcuse, Theodore Adorno, Friedrich Pollock, Erich Fromm, and Leo Lowenthal. See Douglas Kellner, *Critical Theory, Marxism, and Modernity* (Baltimore: John Hopkins University Press, 1989), 12.
7. Theodore Adorno and Max Horkheimer, *Dialectic of Enlightenment,* trans. J. Cummings (New York: Herder and Herder, 1972 [1944]).
8. David Held, *Introduction to Critical Theory: Horkheimer to Habermas* (Berkeley: University of California Press, 1980), 170.
9. Herbert Marcuse, *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society* (Boston: Beacon Press, 1964), 154–55.
10. Ibid., 158–59.
11. Ibid., 11.
12. Ibid., 145.
13. Ibid., 227.
14. Ibid., 218.
15. Ibid., 221.
16. Ibid., 256.
17. Ibid., 338.
18. Herbert Marcuse, *The Aesthetic Dimension: Toward a Critique of Marxist Aesthetics* (Boston: Beacon Press, 1978).
19. Marcuse, *One-Dimensional Man,* 239.
20. Herbert Marcuse, *Counterrevolution and Revolt* (Boston: Beacon Press, 1972), 60.
21. Jürgen Habermas, *Toward a Rational Society: Student Protest, Science, and Politics,* trans. Jeremy J. Shapiro (Boston: Beacon Press, 1968).
22. Ibid., 96.
23. Ibid., 88.
24. Ibid., 57.
25. Ibid., 118.
26. Ibid., 120.
27. Feenberg, *Alternative Modernity,* 35.
28. Jürgen Habermas, *The Theory of Communicative Action,* 2 vols., trans. Thomas McCarthy (Boston: Beacon Press, 1984–1987).

29. Feenberg, *Alternative Modernity,* 81.
30. Feenberg, *Questioning Technology,* 76.
31. According to Feenberg, essentialist philosophies of technology originated with Heidegger and were further developed by the Frankfurt Schoolers (*Questioning Technology*).
32. The failure of a proletariat-led revolution initiated a shift in Marxist thought in the early twentieth century. In short, this involved a moving away from Scientific Marxism, or economism, to a more philosophically oriented theory. Karl Korsch and Georg Lukács are largely credited with initiating this shift.
33. Feenberg broadly conceives SCOT to include social constructivists, contextualist historians of technology, and actor-network theorists. There have been a number of edited volumes on the SCOT since the current rage began in the early 1980s. See for example, Donald A. MacKenzie, and Judy Wajcman, eds., *The Social Shaping of Technology: How the Refrigerator Got its Hum* (Philadelphia: Open University Press, 1985); Weibe Bijke, Thomas Hughes, and Trevor Pinch, eds., *The Social Construction of Technological Systems* (Cambridge: MIT Press, 1987); Weiber Bijker and John Law, eds., *Shaping Technology/Building Society: Studies in Sociotechnical Change* (Cambridge: MIT Press, 1992).
34. Feenberg, *Questioning Technology,* 78–83.
35. Ibid., 11.
36. The concept of symmetry has its origins in the "Strong Program" of the sociology of scientific knowledge. The idea is that the analyst must suspend truth or falsity in order to give all perspectives a fair analysis. See David Bloor, *Knowledge and Social Imagery* (London; Boston: Routledge, 1973).
37. Feenberg, *Questioning Technology,* 213.
38. Ibid., 76.
39. Ibid., 105.
40. Ibid., 88.
41. Feenberg, *Alternative Modernity,* 87.
42. Ibid., 92.
43. Feenberg, *Questioning Technology,* 126.
44. Feenberg, *Alternative Modernity,* ch. 5.
45. Feenberg, *Questioning Technology,* 203–204.
46. Feenberg claims that this is roughly analogous to Bruno Latour's discussion of "enrolling" actors into networks. Latour, for example, uses Pasteur's development of germ theory to illustrate how system builders enroll actors into their networks. See Bruno Latour, *The Pasteurization of France* (Cambridge: Harvard University Press, 1988).
47. Used by permission of author (Feenberg, *Questioning Techology,* 221).
48. Ibid., 205–207.
49. Ibid., 98.
50. The commodity form mystifies the productive relations that go into the product and thereby hides the exploitative labor relations that produce the commodity. See Karl Marx, *Capital: A Critical Analysis of Capitalist Production,* vol. 1, ed. Frederick Engels (New York: International Publishers,1967[1867]), 77.
51. Feenberg, *Questioning Technology,* 211.
52. See Feenberg's discussion of "Instrumentalization Theory" in this volume.
53. Discussed in chapter 3 of *Questioning Technology.*

PART 1

Theoretical Assumptions of a Critical Theory of Technology