TECHNOLOGY CHOICE

A Critique of the Appropriate Technology Movement

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A Review of Plausible Criticisms

Socio-political Obstacles to Appropriate Technology

In Chapter Nine a range of criticisms of Appropriate Technology were examined. A large number of these were shown to be misdirected or unfounded. Some criticisms, however, those labelled "political" criticisms, were found to possess a degree of plausibility. It was found that the profusion of implausible criticisms has probably been facilitated by the lack of an integrated framework for construing Appropriate Technology. Rejoinders to the implausible criticisms were raised in Chapter Nine, and most of these were conditional upon Appropriate Technology being understood in terms of the integrated framework subsequently outlined in Chapter Ten. A full response to the plausible political criticisms was not possible prior to the articulation of an systematic model of Appropriate Technology.

The integrated framework has confirmed the earlier analysis of the implausible criticisms by indicating how the normative concerns of the Appropriate Technology movement might be adequately addressed without having to neglect considerations of technical efficiency, economic viability, physical practicability or intellectual-cum-cultural sophistication. Rejoinders to the implausible criticisms depend in a number of cases upon empirical evidence and not just logical analysis; Chapter Ten provides a framework for incorporating surveys of technical-empirical evidence from earlier chapters into a forceful defence of the Appropriate Technology concept. Many of the implausible criticisms are unconvincing precisely because of a failure to acknowledge the tripartite make-up of Appropriate Technology and a failure to take full cognizance of the difference between technological artefacts and Appropriate Technology as a mode of technology-practice.

A number of the political criticisms considered in Chapter Nine were shown to be unfounded. Most of these looked upon Appropriate Technology as if its protagonists were largely concerned only with technical-empirical considerations. Part Two indicated that the Appropriate Technology movement, with or without a universally attested conceptual model, has always addressed factors other than technical-empirical ones (notwithstanding some exceptions to the general rule). By formally and explicitly incorporating socio-political and ethical-personal factors the integrated framework strengthens our refutation of the "narrow technicism" and "technological determinism" criticisms. As it stands, however, Chapter Ten does not provide a full response to the relatively plausible criticisms of Appropriate Technology.

The plausible criticisms of Appropriate Technology, as indicated earlier, do not invalidate the concept and movement but rather raise questions about the prospects for the Appropriate Technology innovation strategy being taken up on more than a marginal basis. This chapter will examine whether the integrated framework provides a way of assessing the grounds for hope that the applicability of Appropriate Technology may be enhanced sufficiently to overcome the constraints to its successful diffusion.

Before proceeding further, the scope of the obstacles to Appropriate Technology will be described more precisely. The term "political" has been used rather loosely in earlier chapters and in much of the literature on the politics of technology. Politics may be understood in a narrow sense where it concerns the professional activities of politicians in their official capacity as representatives of their constituencies, the functions of formal political parties and associated institutions, and the interaction between these entities. For most proponents of Appropriate Technology the political dimension of Appropriate Technology extends far beyond this narrow conception of politics. Schumacher's comments are illustrative:[1]

> I have no hope in politicians. Politicians are the executive committee of the majority. … On the whole the change that is necessary will never come from the majority.

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[1] E. F. Schumacher: "Alternative Technology: Gordon Laing, Dorothy Emmet and Anthony Appiah talk to Fritz Schumacher, Founder of the Intermediate Technology Development Group", *Theoria to theory*, **9**, 1 (1975), 15; *Technology with a Human Face* (Perth, Aust.: Campaign to Save Native Forests, 1977), p. 5.

> … I would invite you to think about politics. We have developed a strange type of politics, where we occasionally change the crew, and the new crew does exactly the same as the old crew, except in favour of slightly different people. As long as the technology doesn't change, they can't do anything …

Politics may also be understood in a broader sense which takes account of the structural forces of society, the conflict of interest between different social power groups, and the manner in which these forces and conflicts bear upon the formal entities mentioned above. A further, even broader conception of politics may be envisaged, which may or may not incorporate the formal institutions which characterize the narrow conception, viz.: all human activities which involve the exertion of power in society for the purpose of either maintaining or reforming the environment (psychosocial or biophysical) and its structure.

This broadest conception of politics is the most relevant from the point of view of assessing the prospects for Appropriate Technology, and it cannot be isolated from factors normally denoted by terms such as "social", "cultural" or "institutional". A more useful term for describing the obstacles to Appropriate Technology outlined in the criticisms chapter would be "socio-political", rather than just "political". *The integrated framework for Appropriate Technology developed here stresses that, in the main, socio-political change cannot be effectively achieved without concomitant and suitable technological change. The framework incorporates the main insights of the "political" critics but adds that technology deserves attention as a factor in its own right and not just as a minor adjunct to "politics".* Portraying Appropriate Technology as a mode of technology-practice makes it possible to avoid the problem of artificially separating the technological and the political (a problem encountered with specific-characteristics definitions of Appropriate Technology).

Socio-technical Obstacles to Appropriate Technology

Many of the socio-political criticisms canvassed earlier were based upon the imputation that Appropriate Technology embodies a crude doctrine of technological determinism. This imputation was shown to be superficial and misdirected. In Chapter Nine it was argued that the term "technological determinism" is frequently used in an ambiguous and misleading way, but it was agreed that the adoption of an absolute

technological determinist stance would be inconsistent with the main tenets of Appropriate Technology. It was also argued that a common weakness of the "political" criticisms is their failure to address properly the characteristics and dynamics of technology, and their tendency to artificially separate the political from the technological. It was suggested that the Appropriate Technology innovation strategy ought to be seen as a form of politics rather than as an attempt to bypass politics. Elaboration of this theme was left, however, to follow the outlining of an integrated framework for Appropriate Technology.

In Part Two it was indicated that the bulk of the impetus for Appropriate Technology in the North appears to have come from responses to the perceived growth of the technological society. According to a number of commentators on the technological society, technology is subject to laws of progress which are independent, or at least semi-independent, of human judgements as to what is desirable.

Chapter Ten listed as a corollary of Appropriate Technology that technology-practice may act as a determining factor in society. It was pointed out that this does not amount to a disguised doctrine of technological determinism. Nevertheless, if considered in isolation, this corollary could be construed as consistent with technological determinism and, in view of the ambiguity with which "technological determinism" is employed in the literature, the subject deserves further discussion.

While most of the published criticisms of Appropriate Technology stem from a socio-political perspective (where "socio-political" is taken to be discrete vis-à-vis "technological"), earlier chapters have hinted at another possible perspective from which the practicability of Appropriate Technology might be questioned: the socio-technical perspective. While Appropriate Technology has been criticized from both the socio-political and the socio-technical perspectives, the two schools of thought associated with each perspective tend to be at theoretical loggerheads.

The school of thought associated with the socio-technical perspective is exemplified by the writings of people such as: Ellul, Marcuse, Mumford, Heidegger, Galbraith, Habermas, Horkheimer, and, in a different sense, Weiner or Steinbuch. These and other writers in the school are united by a view that technology seems to have developed in an apparently indomitable manner in urban-industrialized societies.[2] It is

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[2] See, e.g.: J. Ellul, *The Technological Society*, trans. by J. Wilkinson (New York: Knopf, 1964); J. Ellul, *The Technological System* (New York: Continuum, 1980); H. Marcuse, *One Dimensional Man* (Boston: Beacon Press, 1964); L. Mumford, *Technics and Civilization* (New

claimed that while technology has always been a part of human culture, it has gained such prominence, centrality and complexity that it may no longer be thought of as subservient to conscious human control or traditional human institutions. In other words, technology has become "autonomous technology". Winner, in his widely cited review of this school of thought, summarizes the notion of autonomous technology as follows:[3]

> At the outset, the development of all technologies reflects the highest attributes of human intelligence, inventiveness and concern. But, beyond a certain point, the point at which the efficacy of the technology becomes evident, these qualities begin to have less and less influence upon the final outcome; intelligence, inventiveness and concern effectively cease to have any real impact on the ways in which technology shapes the world.

Ellul, perhaps the most trenchant exponent of this perspective, writes:[4]

> Everything takes place as if the technological phenomenon contained some force of progression that makes it move independently of any outside interference, of any human interference, of any human decision … The technological phenomenon chooses itself by its own route … [If] man produces the self-augmentation of technology (which could not generate itself, of course), he does so by assuming only an occasional and not a creative role. He cannot help but produce this augmentation; he is conditioned, determined, destined, adjusted, and preformed for it.

Elsewhere he succinctly concludes:[5]

York: Harcourt Brace Jovanovich, 1963; originally published in 1934); M. Heidegger, *The Question Concerning Technology - and Other Essays* (New York: Harper Colophon, 1977); J. Habermas, *Toward a Rational Society*, trans. by J. Shapiro (London: Heinnemann, 1971); M. Horkheimer, *Critique of Instrumental Reason* (New York: Seabury, 1984); J. K. Galbraith, *The New Industrial State* (2nd. ed.; Harmondsworth: Penguin, 1972); N. Weiner, *The Human Use of Human Beings: Cybernetics and Society* (Cambridge, Mass.: The Riverside Press, 1950); K. Steinbuch, *Automat und Mensch: Über Menschliche und Maschinelle Intelligenz* (Berlin: Springer Verlag, 1965). Note: a comparative review of Habermas, Weiner and Steinbuch has been conducted by E. Schuurman in Technology *and the Future: A Philosophical Challenge* (Toronto: Wedge, 1980), pp. 17-260. An interesting anthology of recently published articles which may be loosely grouped under the rubric of "socio-technical", but not all of which adopt the "autonomous technology" notion, has been edited by P. L. Bereano (*Technology as a Social and Political Phenomenon* [New York: John Wiley and Sons, 1976].

[3] L. Winner, *Autonomous Technology:Technics-Out-of-Control as a Theme in Political Thought* (Cambridge, Mass.: MIT Press, 1977), pp. 313-314.

[4] Ellul, *Technological System*, p. 233.

[5] *Ibid*., p. 256.

> Technology develops not in terms of goals to be pursued but in terms of already existing possibilities of growth.

To the extent that the historical development of technology exhibits the kind of autonomy expressed here the concept of Appropriate Technology appears impracticable.

Appropriate Technology relies upon the capacity of human beings to tailor technology to fit its psychosocial and biophysical context - that is, using Ellul's words, to ensure that technology develops in terms of goals to be pursued. Ellul argues that in the technological society such a function may only be fulfilled "occasionally" and not "creatively". He also argues that technology is intrinsically systemic in nature and that, as society becomes increasingly technological, it also takes on the characteristics of technical systems. Thus, in the technological society the context of technology becomes increasingly technological. The frame of reference for assessing technology consequently exhibits similar features to the technology to be assessed. According to Ellul's portrayal of modern urban-industrialized society, human beings lack operable reference points other than technical ones for judging technical phenomena.[6] It is this perceived difficulty of transcending the sphere of technical rationality that lies behind Marcuse's portrayal of modern industrial society as "one dimensional".[7]

The Appropriate Technology innovation strategy requires the multi-dimensional assessment of technology. The multi-dimensional assessment of technology, however, would appear immensely difficult to achieve in a society with a preponderance of a one-dimensional mode of rationality. Amongst the corollaries of the Appropriate Technology concept are the additional requirements that human beings have the power to *control* technology and *choose* between alternative technologies. If technology is indeed autonomous, as the socio-technical perspective appears to indicate, then Appropriate Technology is undermined.

There are, nevertheless, some thinkers in opposition to the notion of autonomous technology. The existence of autonomous technology is strongly disputed by some political theorists, particularly those in the Marxist tradition, because it conflicts with conventional concepts of po-

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[6] See, esp., *ibid*., pp. 310-325.

[7] H. Marcuse, *One Dimensional Man* (Boston: Beacon Press, 1964).

litical hegemony.[8] For most Marxists the idea that technological change might exhibit some form of internal objective logic is a negation of a basic tenet of Marxism; viz., that the "social relations of production", together with the "productive forces" (a combination of labour-power and the means of production, broadly defined), provide the decisive explanation for the dynamics of a society.[9] It is frequently unclear in Marxist publications whether technology is equivalent to the means of production, whether it is part of the means of production or whether it is something different again. Nevertheless, the dominant Marxist view, represented by Braverman or Thompson, for example, holds that technological change is determined by social relations; technology is placed in a subservient position to non-technological factors in society.[10]

It is not possible to debunk the apparent threats to Appropriate Technology posed by autonomous technology, however, simply by citing the above Marxist view. Firstly, Marxism itself is inconsistent on these matters.[11] Furthermore, as demonstrated by Elster, this inconsistency may be traced back to Marx himself, and it is possible to argue plausi-

[8] E.g., D. MacKenzie and J. Wajcman, "Introductory Essay", *The Social Shaping of Technology*, ed. by D. MacKenzie and J. Wajcman (Milton Keynes: Open University Press, 1985), pp. 2-25.

[9] H. Braverman, *Labour and Monopoly Capital: The Degadation of Work in the Twentieth Century* (New York: Monthly Review Press, 1974); H. Thompson, "The Social Significance of Technical Change", *The Journal of Australian Political Economy*, **8** (July 1980), 57-68. Cf., A. Zvorikine, "Technology and the Laws of its Development", paper presented to the Encyclopaedia Britannica Conference on the Technological Order, March 1962, Santa Barbara, California, in *The Technological Order*, ed. by C. F. Stover (Detroit: Wayne State University Press, 1963), pp. 59-74. A recent publication, edited by M. Dubofsky, brings together papers which deal with this topic (*Technological Change and Workers' Movements* [London: Sage, 1985]).

[10] Thompson admits at one stage ("Social Significance of Technical Change", p. 57) that technology might also affect the forces and relations of production as well as be affected by them. The whole force of his argument, however, is to deny the mutuality of determining influences. A similar tendency is found in the work of R. Johnston (whose views on Marx are less apparent) who, in his critique of Collingridge's work, appears to acknowledge the two-way determination between technological change and broader social change; yet, the force of his argument is that technology is quite malleable in the face of social pressures whereas the reverse does not hold (R. Johnston: "Controlling Technology: An Issue for the Social Studies of Science", *Social Studies of Science*, **14** [1984], 97-113; "The Social Character of Technology [Reply to Collingridge]", *Social Studies of Science*, **15** [1985], 381-383).

[11] See the two works by Marxist scholar, A. Gouldner (*The Two Marxisms: Contradictions and Anomalies in the Development of Theories* [New York: Seabury, 1980]; *The Dialectics of Ideology and Technology* [New York: Seabury Press, 1976]).

bly that Marx too actually held technological change to be the prime mover of history.[12]

Secondly, the weight of analytical and practical evidence for the phenomenon of autonomous technology, provided by writers from the socio-technical perspective, is not easily dismissed. When understood in its broadest sense, as the growing dominance of technical rationality in society, the theme of autonomous technology has been addressed in sociology for some time.[13] The theme of autonomous technology has also recurred extensively throughout Western literature.[14]

The *mutual* interaction of social relations and technology is increasingly being recognized by Marxists.[15] Some recent Marxist publications even openly acknowledge the phenomenon of autonomous technology. Mathews, for example, writes:[16]

> We now have to recognize that the socialist dream of liberation from nature has become for us the capitalist nightmare of technology grown out of control.

In short, there are insufficient grounds to conclude that Marxist polemic against the doctrine of technological determinism constitutes a substantive rebuttal of Appropriate Technology.

There is a prima facie case for believing that some kind of force operates in technological society which accords with the notion of autonomous technology. This is not equivalent to adopting the view that technology is *absolutely* autonomous or independent of social influences. It would appear that the obstacles to Appropriate Technology which

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[12] J. Elster, *Explaining Technical Change* (Cambridge: Cambridge University Press, 1983), esp. pp. 158-184, 209-228.

[13] The work of M. Weber is an example (*The Theory of Social and Economic Organization* [New York: Oxford University Press, 1947]; cf., *Economy and Society* [New York: Bedminster Press, 1968]). A review of academic literature from Weber onwards on the topic of the spread of technical rationality has been conducted by S. Cotgrove ("Technology, Rationality and Domination", *Social Studies of Science*, **5** [1975], 55-78).

[14] See, Winner, *Autonomous Technology*, esp. pp. 13-43.

[15] See, R. Dunford, "Politics and Technology: Unravelling the Connections", in *Public Sector Administration: New Perspectives*, ed. by A. Kauzmin (Melbourne: Longman Cheshire, 1983), pp. 183-199. This is also apparent in a collection of essays sub-edited by A. Huyssen under the rubric of "Machines, Myths, and Marxism" published in *The Technological Imagination: Theories and Fictions*, ed. by T. de Lauretis, A. Huyssen and K. Woodward (Madison, Wisconsin: Coda Press, 1980), pp. 77-131; this collection also reveals the inconsistency within Marxism on this subject.

[16] J. Mathews, "Marxism, Energy and Technological Change", in *Politics and Power, One*, ed. by D. Adlam, et al. (London: Routledge and Kegan Paul, 1980), p. 30.

were labelled earlier as "socio-political" bear some relationship to the obstacles labelled here as "socio-technical". Therefore, a useful response to the criticisms of Appropriate Technology is not to attempt a complete confutation of the ideas in each school of thought, but to understand the *extent* to which the obstacles raised are indomitable and the *manner* in which they are interrelated. The weight of evidence from the literature on technology and society, when reviewed as a whole, points to the need to simultaneously consider socio-political and socio-technical factors in a review of the criticisms of Appropriate Technology. A review which focussed on only one of these types of factors would, by that fact, be unreliable.[17]

While the socio-political and socio-technical schools of thought tend to argue against each other's perspectives, there are certain common features in their perspectives on Appropriate Technology. Unfortunately, however, the writings within each of these schools are marred by semantic confusion similar to that which was identified within the Appropriate Technology movement. To some extent, therefore, the plausible criticisms of Appropriate Technology may be dealt with by a careful analysis of definitions. This matter will be addressed in the next section, but first it is necessary to introduce a new idea.

Addressing the problem of whether the socio-technical obstacles to Appropriate Technology might be surmounted amounts to addressing the problem of whether the purported phenomenon of autonomous technology might be surmounted. To address this problem it is proposed here that Appropriate Technology and Autonomous Technology be viewed as two antithetical technological phenomena. In other words, Appropriate Technology and Autonomous Technology should be viewed as diametrically opposed modes of technology-practice. The implications of this will now be explored.[18]

There is some disagreement amongst those who point to the existence of Autonomous Technology as to its normative significance. One

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[17] MacKenzie and Wajcman, in one of the more informed reviews of this subject ("Introductory Essay", passim.), reveal their preference for interpretations which emphasize socio-political factors as more fundamental than socio-technical factors. The substance of their arguments, nevertheless, points to the dynamics of society and technology as deriving from the complex mutual interactions of technological, social, economic and political factors. This accords with the position we have adopted here and which is embodied in the integrated framework from the previous chapter.

[18] For reasons which will be explained in the following sections the general notion of autonomous technology will hereafter be denoted with capitals as follows: "Autonomous Technology".

pole of opinion views Autonomous Technology as inimical to human wellbeing and as intrinsically violent towards nature. Adherents to this view may be labelled "techno-pessimists". A romantic anti-technological stance is the typical response, characterized by either attempted transcendental withdrawal from intentional involvement in technological activity or by nihilistic acquiescence. We may include such thinkers as Roszak, Reich, Jünger or the members of the "beat generation" as representative.[19] Another pole of opinion views technology (understood in terms similar to Autonomous Technology) as the guarantee of a salubrious future for humankind. Adherents to this view may be labelled "techno-optimists". A romantic pro-technological stance is the typical response characterized by ardent advocacy of technology as the solution to human and environmental problems, or by faith in technology *per se*. Some hold this faith while being fully aware of the potential dangers and violence of technology.[20] Others exhibit a dogmatic faith in the goodness of technology and a commitment to allowing "technological development" to proceed autonomously, unimpeded by human attempts to control or restrain it.[21] Despite the conflict of opinion between the techno-pessimists and the techno-

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[19] See, e.g.: T. Roszak, *The Making of a Counter Culture: Reflections on the Technocratic Society and its Youthful Opposition* (London: Faber and Faber, 1968); C. Reich, *The Greening of America* (New York: Random House, 1970); F. G. Jünger, *The Failure of Technology* (Chicago: Regnery, 1956). For a critical review of the "beat generation" see the work of O. Guiness (*The Dust of Death: A Critique of the Counterculture* [Downers Grove, Ill.: Inter Varsity Press, 1973], esp. pp. 114-274).

[20] The writings of E. G. Mesthene illustrate this perspective (e.g.: "How Technology Will Shape the Future", *Science*, **161** [July 1968], 135-143; *Technological Change* [Cambridge, Mass.: Harvard University Press, 1970]). Mesthene holds that the undesirable aspects of technological change stem primarily from changes in human values lagging behind technological change; he claims that the solution lies in human values being "brought into better accord" (*Technological Change*, p. 62) with contemporary technology. Mesthene employs rhetoric against the notion of Autonomous Technology (e.g., *ibid*., pp. 40-41) but most of his analysis is based upon the assumption that technological change is "given" and proceeds autonomously.

[21] Examples of the perspective include: H. Kahn, *The Next 200 Years: A Scenario for America and the World* (New York: Morrow, 1976); H. Kahn and T. Pepper, *Will She Be Right? The Future of Australia* (Brisbane: The University of Queensland Press and Prentice-Hall International, 1980). Cf., the remarkable series of booklets ("Dialogues on Technology") published by the American company, Gould Inc., Rolling Meadows, Illinois; booklet #1 (*Technology: Abandon, Endure or Advance?*), for example, concludes with the statement: "Can we be sure that science and technology will find the answers? Can we be sure that solutions to our problems exist? No, but we can be sure that nothing but science and technology can find them, if they do exist. To put it as bluntly as possible: science and technology must answer our problems. If they don't, nothing else will" [p. 12]). Faith in the benign nature of unimpeded technological change is apparent in recent publications aimed at demonstrating the social value of so-called "high technology" (see, e.g., R. W. Riche, "The Impact of Technological Change", *Economic Impact*, **41**, 1 [1983], 13-18).

optimists, they may still be viewed as belonging to one school of thought - because of their common assumption about the autonomous nature of technological change (an assumption which may be either tacit or overt).

The optimism of the techno-optimists ought not to be confused with optimism as to the future prospects for Appropriate Technology. The former type of optimism is based upon the confidence that technology itself will bring about a salubrious future and that human beings will adapt to the new technological milieu with minimal social cost. It embodies a normative stance that untrammeled technological change is good and that the imperatives of technology are automatically in accord with the needs of human beings and the purposes of human existence (insofar as such purposes may be held to exist or possess validity). Optimism vis-à-vis Appropriate Technology, in contrast, is based upon different normative premises. Appropriate Technology, on principle (according to our definition and integrated framework), points to the importance of technological change within a community not proceeding independently of the efforts by people in that community to control it and choose its direction. The question of whether there are strong grounds for optimism regarding the future of society vis-à-vis technology may not be reduced to technical-empirical considerations. The meaning of the question depends upon what normative goals are adopted or recognized for society. Thus, the availability of firm empirical evidence for the possibility of the sort of future society envisaged by the techno-optimists does not provide grounds of hope for the success of the Appropriate Technology innovation strategy.

In summary, the plausible criticisms of Appropriate Technology embrace both socio-political considerations and socio-technical considerations. The literature we have surveyed points to the growing prominence of technology in modern societies and in so-called traditional societies. While some commentators view technology simply as an aspect of society and others attribute it greater independence from other factors, most serious commentators point to the mutual interaction and overlapping nature of technology and society; in other words, technology incorporates social factors and society incorporates technological factors. Politics must therefore be vitally concerned with socio-technical factors if it is to adequately address prevailing "real life" circumstances.[22] Political choices need to be understood as requiring com-

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[22] Our term "technology-practice" embodies this insight. It also appears that recognition of this point is the main reason for Winner's use of the term "technological politics" (*Autonomous Technology*, pp. 237-278). Cf., L. Winner, "*Techné* and *Politeia:* The Technical

comitant technological choices - and technological choices need to be understood as either explicit or implicit political-cum-social choices. The "political" criticisms identified in Chapter Nine must be treated as possessing only a limited degree of plausibility if they are understood as excluding the socio-technical perspective outlined above. By emphasizing *both* the socio-technical and the socio-political objections which may be raised against Appropriate Technology a firmer basis has been developed for addressing the problem which was left unresolved at the end of Chapter Nine; i.e., that of identifying whether there are any grounds for hope that the goals of the Appropriate Technology movement may be substantially achieved.

Appropriate Technology and Autonomous Technology

Having reviewed the criticisms of Appropriate Technology we are now in a position to further consider the capacity of the integrated framework to reveal how the obstacles to Appropriate Technology might be surmounted.

A major strength of Appropriate Technology, and a characteristic which features prominently in the synthesis of the concept in this book, is that it is grounded in a recognition of the fundamental role of technology and technology-practice in modern society. Many of the politically oriented criticisms of Appropriate Technology are flawed by a failure to recognize that technology plays a dominant role in the modern world - probably more dominant than it has in the past. While it would be difficult to find a serious attempt in the literature to refute such an observation about technology, many political theorists do not effectively incorporate this notion into the structure of their theories and strategies. One atypical political scientist has noted this in the following manner:[23]

> If it is clear that the social contract implicitly created by implementing a particular generic variety of technology is incompatible with the kind of society we would deliberately choose, then that kind of device or system ought to be excluded from society altogether. A crucial failure of modern political theory has been its inability or unwillingness even to begin this

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Constitution of Society", *Philosophy and Technology*, ed. by P. T. Durbin and F. Rapp [Dordrecht: D. Reidel, 1983], pp. 97-111.

23 Winner, "*Techné* and *Politeia*", pp. 109-110.

project: critical evaluation of society's technical constitution.   The
silence of modern liberalism on this issue is matched by an equally
obvious neglect in Marxist theory.   Both persuasions have en-
thusiastically sought freedom in sheer material plenitude, welcoming
whatever technological means (or monstrosities) seemed to produce
abundance fastest.

The Appropriate Technology innovation strategy may be under-
stood *inter alia* as a political strategy which is superior to other
techno-political strategies insofar as these treat technology as a
largely passive, malleable and *automatically subservient* factor in the
dynamics of society. The political criticisms reviewed in Chapter Nine
may be understood as a reflection of the limitations of dominant politi-
cal theory as much as a reflection of the actual obstacles encountered by
Appropriate Technology.

Another major strength of Appropriate Technology (construed in
the terms of our integrated framework) is that it is capable of clarify-
ing much of the debate over Autonomous Technology. The integrated
framework is based upon the semantic conventions and conceptual cate-
gories specified in Chapter Two, in which the importance of distin-
guishing between technology-practice, technology, technicity, tech-
nique and technological science was stressed. In most of the debate over
Autonomous Technology - especially in the English language - these
categories are frequently confused. Consequently, when commentators
disagree over "autonomous technology" or "technological determinism"
it is not immediately obvious whether there are substantive differences
between their viewpoints or whether the disagreements stem from se-
mantic ambiguity.

The reader is referred to Table 2.1 at the end of Chapter Two for a
list of technology-related nomenclature used in this book. A few of the
most important definitions will nevertheless be reiterated here.
Technology is the ensemble of artefacts intended to function as rela-
tively efficient means. *Technology-practice* is the ensemble of opera-
tions, activities, situations or phenomena which involve technology to
a significant extent. *Technicity* is the distinguishing factor or quality
which makes a phenomenon technical. *"Technical"* is an adjective or
adverb used to qualify phenomena *dedicated* to efficient, rational, in-
strumental, specific, precise, and goal-oriented operations. It is impor-
tant to recognize that there is a distinction between "technological"
and "technical" in these semantic conventions.

If the word "technology" in "autonomous technology" is given the
meaning stipulated in this study then the concept of Autonomous Tech-

nology is clearly difficult to defend. This is because artefacts, in the fi-nal analysis, cannot be absolutely autonomous or completely separated from the sphere of human activity - artefacts, after all, are defined as the products of human art and workmanship.[24] This observation ap-peals so readily to common sense that it is hardly surprising that the notion of Autonomous Technology has been so widely disputed. Even Ellul readily admits that the "technological phenomenon" is generated by human beings and that it could not generate itself.[25] He writes, for example, as follows:[26]

> To speak of a machine that lives and thinks, or even reproduces itself is infantile anthropocentrism … But technology is inevitably part of a world that is not inert. It can develop only in relation to that world. No technology, however autonomous it may be, can develop outside a given economic, political, intellectual context.

Despite passages such as this one, Ellul is frequently castigated for purportedly ignoring the social and political context of technology.[27] Eberhard's description of Ellul is typical:[28]

> Confusion arises in Ellul's work from a failure to treat social conse-quences of technological progress within the context of a more general phenomenon - namely the attempt to shape behavior according to political and economic interests.

One could be tempted to think that Ellul is a rather inconsistent or in-competent scholar - to be known so widely as the most extreme propo-nent of "context-free" interpretations of technology and as a promulga-tor of the Autonomous Technology doctrine, on the one hand, while making statements, on the other hand, such as the one just cited.

A more satisfactory review of the evidence ought to take into ac-count the explanation offered by Ellul himself. Firstly, as indicated by

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[24] J. B. Sykes, ed., *The Concise Oxford Dictionary of Current English* (6th ed.; Oxford: Oxford University Press, 1976), p. 52

[25] Ellul, *Technological System*, p. 233.

[26] *Ibid.*, pp. 30-31.

[27] E.g., H. Rose and S. Rose, "The Incorporation of Science", in *The Political Economy of Science*, ed. by H. Rose and S. Rose (London: Macmillan, 1976), p. 31.

[28] A. Eberhard, *Technological Change and Development: A Critical Review of the Literature*, Occasional Paper in Appropriate Technology, School of Engineering Science, University of Edinburgh, 1982, p. 68.

the foregoing quote, Ellul does not equate technological autonomy with the complete independence of technology from socio-political influences. Secondly, as stressed throughout his writings, Ellul makes a distinction between technologies (*techniques*, French) and what he labels "*La Technique*" (translated into English as the ambiguous "technology").[29] Thus, the concept and phenomenon labelled here as "Autonomous Technology" does not mean that actual technologies are autonomous. Ellul's writings are highly idiomatic and it is not always easy to identify just what it is that he is arguing; he also frequently places discussion of *La Technique* in close proximity to discussion of particular fields of technology-practice. Nevertheless, even a relatively cursory reading of his works makes it apparent that by "*La Technique*" Ellul intends to denote a phenomenon similar to that which many other writers have recognized and which Cotgrove has dubbed as "technological rationality".[30] In his later writings Ellul clarifies the situation by explaining that *La Technique* is a system characterized by "technological rationality". While Ellul doesn't explain this concisely in one place, it is apparent that, for him, *La Technique* is the totality of all technical systems.[31] It would appear that the phenomenon translated into English from Ellul's writing as "technology" would best be denoted by the term "technicity" which was adopted in Chapter Two. Ellul appears to argue, to use our terminology, that systems characterized by a high degree of technicity *ipso facto* exhibit a propensity for autonomy. This is not meant to imply, however, that the autonomy of such systems is absolute in relation to other systems. The following quote from Ellul's work illustrates this point:

> In reality, we must not confuse the technological system and the technological society. The system exists in all its rigor, but it exists within the society, living in and off the society and grafted upon it. There is a duality here exactly as there is between nature and the machine. The machine works because of natural products, but it does not transform nature into a machine. … At a certain level, culture and nature overlap, forming society, in a totality that becomes a nature for man. And into this complex comes a foreign body, intrusive and unreplaceable: the technological system. It does not turn society into a machine. It fashions society in terms of its necessities; it uses society as an underpinning; it

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[29] *Technological Society*; *Technological System*, esp. pp. 23-33; "Technological Order", pp. 10-37.

[30] Cotgrove, "Technology, Rationality", pp. 55-78.

[31] Cf.: *Technological Society*, p. xxv; *Technological System,* passim.

transforms certain of society's structures. But there is always something unpredictable, incoherent, and irreducible in the social body. … It is only at an extreme point that we can view the society and the system as one and the same. But nobody can seriously maintain that this extreme has been reached.

By making a distinction between technology-practice, technology and technicity, and by examining the writings of Ellul in a less cursory manner than appears normal amongst his critics, we are in a better position to understand the significance of Autonomous Technology.

Technicity is a type of process or mode of rationality which, by definition, is autonomous vis-à-vis human purposes. Thus, Autonomous Technology ought to be understood as a mode of technology-practice characterized by the dominance of technicity.[32] The term "appropriate technicity" is absurd because technicity, as understood here, is not open to transformation to anything other than itself. Technicity is not ontologically differentiable - to use philosophical terminology. Qualification of "technicity" with an adjective for the purposes of differentiating it is therefore not semantically acceptable. On this view the only options available to human beings vis-à-vis technicity are to place *limits* or constraints on the degree to which technicity has a role in fields of human endeavor or to increase reliance upon technicity through either conscious commitment to such an option or by a *de facto* failure to place limits on it. "Autonomous Technology" ought therefore to be viewed as a short-hand term for a mode of technology-practice in which no limits have been placed upon the scope and dominance of technicity.

Appropriate Technology, according to our integrated framework, requires that human beings be capable of controlling technology and of adopting one technological option rather than another. This, in turn, requires that there are options available in the kinds of rationale with which a particular case of technology-practice may be imbued. Technology-practice completely dominated by technical rationality (leading to technologies which are a perfect manifestation of technicity) would preclude the possibility of such control and choice. It is for this reason that Appropriate Technology and Autonomous Technology are portrayed here as antithetical modes of technology-practice.

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[32] The term "Technology", as used here in "Autonomous Technology" is, strictly speaking, a misnomer; "technology-practice" would be more consistent with the rest of our analysis. The former term is employed here, however, in keeping with the established use of "Autonomous Technology" (after Winner, *Autonomous Technology*).

If one fails to make the distinction between technology-practice, technology and technicity, one is forced to reject the idea of Appropriate Technology. This is reflected in the debate between Habermas and Marcuse on the possibility of a "new technology".[33] Both of these thinkers appear to confuse the above concepts, with the end result that their writings fail to point to clear grounds for hope for an "Appropriate Technology". Marcuse does point to the possibility of a qualitatively new mode of technology-practice [our terminology] which is imbued with independently constituted human values, viz.:[34]

> … the historical achievement of science and technology has rendered possible the *translation of values into technical tasks* - the materialization of values. Consequently, what is at stake is the redefinition of values in *technical terms*, as elements in the technological process. The new ends, as technical ends, would then operate in the project and in the construction of the machinery, and not only in its utilization.

Marcuse's idea here appears to coincide closely with our version of Appropriate Technology - as an innovation strategy aimed at matching the intrinsic and extrinsic ends of technology.[35] Marcuse, however, proposes his vision of technology imbued with human values against a backdrop of having argued earlier that, in advanced industrial society, the only effective value is the one-dimensional value of technical rationality. Speaking of the "project" of technological progress, for example, he writes:[36]

> As the project unfolds, it shapes the entire universe of discourse and action, intellectual and material culture. In the medium of technology, culture, politics and the economy merge into an omnipresent system which swallows up or repulses all alternatives. The productivity and growth potential of this system stabilize the society and contain technical progress within the framework of domination.

Marcuse points to the possibility of alternative modes of technology-practice but his analysis of society seems to preclude such alternatives.

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[33] J. Habermas, "Technology and Science as 'Ideology'", in his *Toward a Rational Society*, trans. by J. Shapiro (London: Heinemann, 1971), pp. 81-122; Marcuse, *One-Dimensional Man*.

[34] Marcuse, *One-Dimensional Man*, pp. 231-232.

[35] See Chapter Ten.

[36] Marcuse, *One-Dimensional Man*, p. xvi.

This contradiction in Marcuse's work makes his stated hope seem rather gratuitous.[37]

Habermas argues against Marcuse's notion of a new mode of technology-practice [our terminology] on the grounds that technological progress requires the suppression of ethics as a category of human experience.[38] Habermas holds that two mutually exclusive modes of activity are possible, one corresponding to technical rationality and the other corresponding to what is traditionally thought of as the authentic domain of the human spirit. The former he labels "purposive-rational action" (equivalent to our "technicity") and the latter he labels "communicative interaction" (which is the sphere of normative human interest). He argues that the human problems of the technological society stem from a failure to actively maintain the distinction between the "technical" and the "practical" (i.e., communicative interaction within a normative order, ethics and politics).[39] For Habermas, technology may not be "humanized", "transformed" or imbued with non-technical human values; there is an intrinsic contradiction between the two modes of activity and the full pursuit of "practical" human interests may only be achieved if the technical mode is constrained. From this point of view it would be absurd to attempt to make "technology" humanly appropriate - placing limits on the profusion of technology would be the only humanly appropriate option.[40]

This discussion of Habermas and Marcuse may be concluded by noting that, in the final analysis, while both writers appear to write from a normative perspective similar to that which undergirds the Appropriate Technology movement, neither provides satisfactory grounds for confidence in the achievement of the movement's objectives. Marcuse perceives the need for "Appropriate Technology" and he even articulates something of the principles involved, yet his theoretical criti-

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[37] This conclusion here is reinforced by Fromm's insistence that the apparent optimism in Marcuse's work is a thin veil over his complete "hopelessness" (E. Fromm, *The Revolution of Hope: Toward a Humanized Technology* (Perennial Library; New York: Harper and Row, 1964), pp. 8-9). Fromm writes, "Marcuse is essentially an example of an alienated intellectual, who presents his personal despair as a theory of radicalism" (ibid., p. 9).

[38] Habermas, "Technology and Science as 'Ideology'", pp. 81-122, passim., esp. pp. 112-113.

[39] Note: Habermas uses "practical" with a meaning which is quite different to that given to the term in current English (where it often means "expedient" or "efficacious"); for Habermas "technical" and "practical" are mutually exclusive opposites.

[40] This dichotomy between the spheres of the "technical" and the "human" is also apparent in the work of M. Horkheimer (*Eclipse of Reason* [New York: Columbia University Press, 1947).

cism of the technological society (upon which his prognosis depends) appears to also undermine his hopes. Habermas adopts a seemingly more rigorous intellectual framework than Marcuse, but his recommendations on how a humanly desirable future may be achieved do not include a positive role for technology. Given that both writers point to the domination of all fields of human endeavor by technological modes of operation and by the imperative of technological progress, it is hard to see how their analyses may provide a sanguine view of the future. Both Marcuse and Habermas point to the need for a complete reversal in the dynamics of society, but their abstract polemic does not provide an indication of how this might be achieved at the level of technology-practice.[41] Both writers observe the phenomenon of Autonomous Technology, but neither is prepared to accept it as a *fait accompli*.[42] This apparently unresolved tension in their work appears to derive from their failure to embrace and rigorously apply the distinction between technology-practice, technology and technicity.

This discussion of Marcuse and Habermas has not been included here merely for reasons of pedantry. Rather, their writings, the interpretation of which appears to have generated a notable academic industry, have significant ramifications for Appropriate Technology.[43] If we accept Habermas' theories and his critique of Marcuse, then we are forced to conclude that the achievement of the Appropriate Technology movement's normative goals has very little to do with technology as such - this conclusion amounts to a rejection of a chief tenet of the movement.

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[41] This hope for a complete "reversal" in the direction of social reality (or more completely, in metaphysical terms, in the direction of being) is also apparent in the work of Heidegger. Cf.: Heidegger, *Question Concerning Technology*; Lovitt, "Techne and Technology - Heidegger's Perspective on What is Happening Today", *Philosophy Today* (Spring 1980), 62-72.

[42] E.g., Habermas speaks of "systems of purposive-rational action that have taken on a life of their own" ("Science and Technology as 'Ideology'", p. 113) yet elsewhere he refers to this phenomenon as the "quasi-autonomous progress of science and technology" (*ibid*, p. 105).

[43] For evidence of this "industry" see, e.g.: J. B. Thompson and D. Held, eds., *Habermas: Critical Debates* (London: Macmillan, 1982); J. J. Shapiro, "The Dialectic of Theory and Practice in the Age of Technological Rationality: Herbert Marcuse and Jürgen Habermas", in *The Unknown Dimension: European Marxism Since Lenin*, ed. by D. Howard and K. E. Klare (New York: Basic Books, 1972), pp. 276-303; N. Stockman, "Habermas, Marcuse and the *Aufhebung* of Science and Technology", *Philosophy of the Social Sciences*, **8** (1978), 13-55. In view of the extensive debate in the social science literature over Habermas and the "critical theorists" of the Frankfurt School, the space which has been devoted to the relevant theoretical issues in this chapter is quite appropriate. To pursue the debate any further, however, would be beyond the purview of this study.

The formulation of Appropriate Technology presented herein, however, provides a basis for resolving the apparent tension just identified in the writing of Habermas and Marcuse. It is possible to maintain the view that "technology" (i.e., technology and technology-practice) is ontologically differentiable while simultaneously accepting the power of Habermas' claim that "technology" (i.e. technicity) is not ontologically differentiable. This means, in less philosophical language, that it is possible to seriously maintain the possibility of choices between alternative technologies and between alternative modes of technology-practice, without disregarding the propensity for autonomy (and the consequential lack of practical choice)[44] within technical systems - that is, within technological systems which are completely dominated by technicity. In other words, *so long as technology-practice is not dominated by technicity the Appropriate Technology innovation strategy is a realistic possibility.*

In view of the foregoing analysis and, in particular, the claim that Autonomous Technology and Appropriate Technology ought to be understood as antithetical modes of technology-practice, we are now in a position to restate these two concepts in a form which will clarify the problems under consideration.

To point to the existence of Autonomous Technology is not to deny the socio-political determination of technology-practice nor to suggest that individual technologies may be generated entirely independently of human decision. Instead, it is proposed here that "Autonomous Technology" be employed to denote a mode of technology-practice dominated by technical systems and by the failure of human beings to place limits on the scope of technicity. Technology-practice is not intrinsically autonomous vis-à-vis human control but, because of the propensity of highly technical systems for autonomy, technology-practice may exhibit a degree of contingent autonomy in the context of the technological society and where limits have not been placed on the dominance of technicity. According to this view human beings can exert control over technological systems but only when deliberate constraints have been placed upon technicity. In other words, human autonomy vis-à-vis technology is not automatic in the technological society but requires deliberate and concerted effort.

To point to the possibility of Appropriate Technology is not to deny the existence of Autonomous Technology, even though the two have been portrayed herein as antithetical. *It is proposed here that*

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[44] "Practical" is used here with Habermas' meaning rather than with the dominant meaning it possesses in current English.

"Appropriate Technology" be employed to denote a mode of technology-practice aimed at achieving a good technological fit and based upon the deliberate imposition of limits on technicity. The imposition of limits on technicity does not in itself guarantee that technology-practice is "appropriate" but creates an essential pre-condition for the implementation of Appropriate Technology.[45]

It may be concluded, at this point, that the analyses of the writers within the "socio-technical" perspective do not constitute an effective rebuttal of Appropriate Technology. The only defensible notion of Autonomous Technology is one which views it as a contingent phenomenon rather than as an absolute and immutable phenomenon. The critics of "technological determinism" and, often by association, of Appropriate Technology, do not generally address the crucial distinction between absolute and contingent technological autonomy (or technological determinism). Consequently, as reflected in Chapter Nine, much of the emerging technology studies literature is spent debating a pseudo-problem; i.e., protagonists from the socio-political perspective criticize protagonists from the socio-technical perspective for holding to a position (absolute technological determinism) which they do not in fact embrace. The "politics" oriented thinkers frequently argue as if political hegemony is an immutable, absolute and eternally "given" fact and consequently interpret *any* acknowledgment of technological autonomy as completely incompatible with a creative role for human beings and with the processes of politics. The Appropriate Technology movement may be interpreted as an attempt to get beyond this ideological impasse by acknowledging the tendency towards autonomy in technological systems yet also pointing to the possibility of such a tendency being negated.

By taking into account certain, at times philosophical considerations, this chapter has shown how no sustainable fundamental theoretical objections to Appropriate Technology have been seriously argued in the literature. This does not, however, provide any guarantee that Appropriate Technology will be successfully diffused as the dominant

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[45] It appears that, despite his criticisms of Appropriate Technology, Ellul is actually in agreement with the basic tenets of Appropriate Technology (as per our integrated framework). He makes this explicit in a footnote: "The sole act of authentic, verifiable, and concrete control of technology would be to set limits to its development. But this is the very contradiction of the system. Contrary to what many people may think, setting limits creates freedom. Illich's thinking here coincides with mine. And I feel that nothing is as fundamental as this problem of voluntary limits" (*Technological System*, p. 355). The point we are making here is dependent, however, upon understanding that it is to technicity rather than technology-practice or technology that Ellul refers.

mode of technology-practice.   Whether   or not there are adequate grounds for hope that this may occur will be the main focus of the final chapter.